CQ Inc.

Coal Characterization of West Kentucky No. 11 Seam Coal

to

U.S. Department of Energy
Pittsburgh, Pennsylvania
DE-FC22-90PC89663

Electric Power Research Institute
Palo Alto, California
RP1400-25

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Table of Contents

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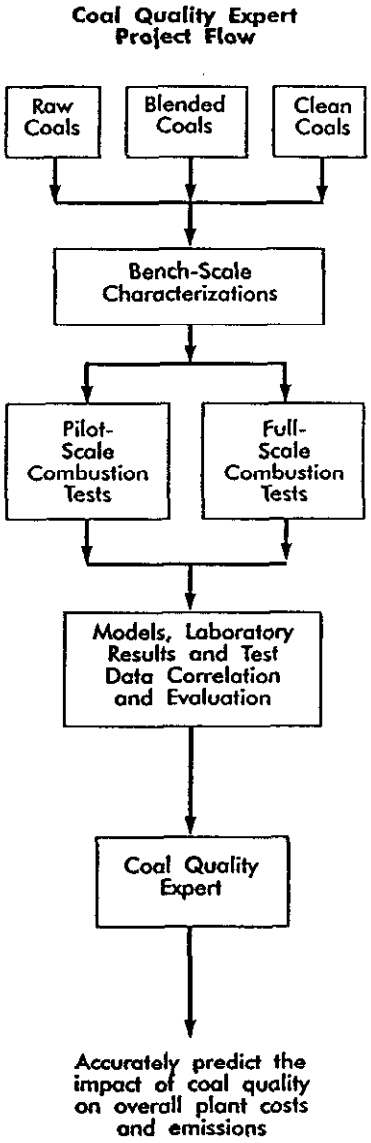
The following made important contributions to the data and results presented in this report:

- Island Creek Coal Company, which donated 250 tons of West Kentucky Seam coal from its Ohio No. 11 mine near Uniontown, Kentucky.

- Mr. Greg Henshaw of Southern Company Services, Inc., which co-funds the Clean Coal Technology project for which this characterization was performed. Mr. Henshaw made arrangements for mine and preparation plant visits to Island Creek Coal Company's sites.

EXECUTIVE SUMMARY



CQ Inc., a wholly-owned subsidiary of the Electric Power Research Institute (EPRI), performed a Coal Cleanability Characterization on 250 tons of West Kentucky No. 11 Seam coal. Island Creek Coal Company supplied this coal from its Ohio No. 11 Mine located in Union County, Kentucky. The work was performed in late 1990 and early 1991 as part of a Clean Coal Technology project sponsored by the Department of Energy and the Electric Power Research Institute. The objective of the project is to develop a sophisticated computer model, the Coal Quality Expert, that will help to reduce power plant emissions and power production costs.

The project is a logical and essential extension of extensive R&D performed in the past under sponsorship of the U.S. Department of Energy (DOE). The 45-month project, managed by CQ Inc. and ABB Combustion Engineering Systems Division, will demonstrate the economic and environmental benefits of coal cleaning to enhance the use of U.S. coals for electrical power generation. The work falls under DOE's Clean Coal Technology Program in the category of "Advanced Coal Cleaning."

The main objectives of this project are to:

- Enhance EPRI's Coal Quality Information System database and Coal Quality Impact Model to allow confident assessment of the effect of cleaning on specific boiler cost and performance.

- Develop and validate a computer workstation, called the Coal Quality Expert, which allows accurate and detailed predictions of coal quality impacts on total power plant capital cost, operating cost, and performance based on inputs from inexpensive bench tests.

Project Tasks

The project consists of seven tasks:

Task 1: Project Management

Task 2: Coal Cleanability Characterization

Task 3: Pilot-Scale Combustion Testing

Coal Cleanability Characterizations are comprised of five segments:

- *Raw Coal Characterization*
- *Impurities Liberation Testing*
- *Laboratory Froth Flotation*
- *Commercial-scale Flowsheet Testing*
- *Combustion Characteristics Comparison*

Task 4: Utility Boiler Field Testing

Task 5: CQIM Completion and Development of CQE Specifications

Task 6: CQE Development

Task 7: CQE Workstation Testing and Validation

CQ Inc. owns and operates the Coal Quality Development Center (CQDC), located 50 miles east of Pittsburgh, Pennsylvania. One portion of the research and development at CQ Inc. involves such characterizations, which determine a coal's response to cleaning as defined by a five-part test program.

Results

The raw-coal characterization showed that the Kentucky No. 11 Seam coal is a high volatile C bituminous coal with a medium slagging index, a medium fouling index, an SO_2 emissions potential of 8.38 lb/MBtu, and an ash loading of 39.26 lb/MBtu. No great amount of impurities liberation occurred in the raw coal until it was crushed to 100 mesh. The coal cleaning evaluation showed that cleaning can improve the quality of West Kentucky No. 11 Seam coal but with low yield (45-60 percent) and only moderate energy recovery (70-85). Moveover, even though coal quality can be improved with cleaning, the SO_2 emissions potential cannot be reduced below the 1.2 lbs/MBtu requirement of the 1990 Clean Air Act because of the high organic sulfur (1.7 percent on a dry basis) contained in this coal. Not only did cleaning the raw coal not reduce the slagging index classification, it actually increased the calculated values slightly. The slagging index rose from 1.07 to 1.4 in Test 1, to 1.27 in Test 2, and 1.29 in the commercial plant clean coal. The fouling index rose from 0.21 to 0.42 in Test 1, to 0.49 in Test 2, and 0.35 in the commercial plant clean coal.

The data from this characterization will be incorporated into two of the more than 20 software models and databases that will be integrated to form the Coal Quality Expert:

- EPRI's Coal Quality Information System (CQIS), a database of coal characteristics and cleaning potential.

- EPRI's Coal Quality Impact Model (CQIM), a commercial program that gives the bottom-line cost of burning a given coal in a particular boiler.

INTRODUCTION

CQ Inc.'s Coal Quality Development Center (CQDC) is a 25-tph commercial-scale coal cleaning facility involved in the development and demonstration of coal cleaning processes and systems. It provides utilities with information that allows a realistic evaluation of various coal supply options. The CQDC also characterizes important coal seams for their raw coal quality characteristics and amenability to cleaning.

Barge Unloading Dock at Watson Station. *Barges carry clean coal from Island Creek Coal Company's Ohio No. 11 Mine down the Mississippi River to Mississippi Power Company's Watson Station.*

For the Coal Quality Expert (CQE) project, which is developing a complex, integrated expert system to accurately determine the performance and emissions costs of coal-fired power generation, CQ Inc. engineers characterized the Western Kentucky No. 11 Seam coal from Island Creek Coal Company's Ohio No. 11 Mine in Union County, Kentucky. Currently, this coal is cleaned at the Island Creek Coal Company's preparation plant located at the mouth of the mine. The preparation plant consists of a heavy-media vessel for cleaning coarse material and heavy-media cyclones for the intermediate size material. The fine material is sent to impounding ponds. Cleaned coal from this plant is shipped to Mississippi Power Company's Watson Generating Station in Gulfport, Mississippi.

For this study Island Creek Coal Company donated 250 tons of raw West Kentucky No. 11 coal. The characterization, which was performed in December 1990 and January 1991, had two major objectives:

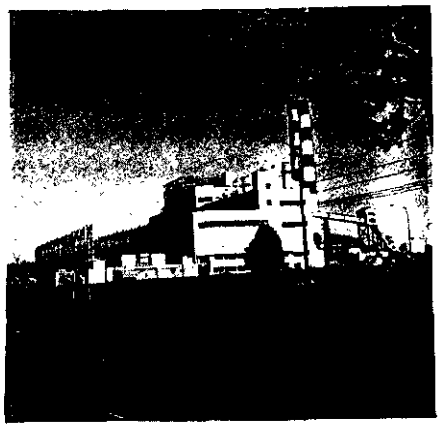
- To determine the extent to which crushing the raw coal liberates ash-forming minerals, including pyritic sulfur.
- To determine the extent to which this coal can be economically cleaned.

Watson Generating Station Test Program

West Kentucky No. 11 Seam coal is found as the name implies in western Kentucky. Other seams with the same USBM bed code number can be found in Illinois and Indiana. West Kentucky No. 11 Seam coal accounts for 15 to 25 percent of the coal mined in the state of Kentucky.

Mississippi Power Company's Watson Generating Station is one of six host sites involved in the CQE project. Because Watson Generating Station has in the past experienced slagging and fouling problems when burning West Kentucky No. 11 Seam coal, it was chosen as one of the coals for the CQE field tests at Watson. Data from the field tests offered the potential for learning more about slagging and fouling phenomena.

A second coal for testing at Watson was a blend of Illinois No. 2, 3, and 5 seam coals. The Illinois blend coal is very



Mississippi Power Company's Jack Watson Steam Plant in Gulfport, Mississippi. *This is the site of CQE's second field test. During the test of Unit No. 4, a 250 MW unit, plant operating staff gained valuable information about boiler and electrostatic precipitator performances. Based on this information, unit modifications are taking place.*

similar in quality to West Kentucky No. 11, but when previously burned at the Watson Station, it causes few problems with slagging and fouling. This easier-to-burn coal was chosen as the base coal for full-scale test burns on Unit No. 4. Test burns at Watson Generation Station were performed to compare West Kentucky No. 11 Seam coal with the base Illinois coal blend to determine the cause of slagging and fouling when firing West Kentucky No. 11 coal.

The CQ Inc. raw coal characterization and cleaning tests also helped to determine what caused the slagging and fouling and if deeper cleaning can reduce the potential for slagging and fouling. For this project two flowsheet tests were performed on the West Kentucky No. 11 coal to investigate the effect of levels of cleaning on slagging and fouling. Both medium- and deep-cleaned coals produced from the flowsheet tests were cleaner than the commercially cleaned West Kentucky No. 11 coal that normally fires the Watson Generating Station.

CQ Inc. Investigations

For this test program, CQ Inc. engineers followed EPRI's coal cleanability characterization procedures. EPRI developed the concept of coal cleanability characterizations in 1983 and since then over 35 coals have been tested using this set of procedures. To date over 100 raw and clean coal data sets have been obtained for EPRI's Coal Quality Information System (CQIS). The CQE project has provided the opportunity to expand CQIS with data on coals from new geographic areas and/or coals that can cause and/or prevent problems at power plants.

Table 1 summarizes the CQ Inc. investigations conducted for this test program.

Table 1. Investigations and Determinations.

Investigations	Determinations	Nature of Study
RAW-COAL CHARACTERISTICS	• Raw-Coal Quality • Coal Rank • Size Distribution • Washability Analyses	Laboratory Analysis
IMPURITIES LIBERATION POTENTIAL	• Reduced Size Distribution • Additional Ash and Sulfur Liberation • Theoretical Quality Versus Yield Relationship	Laboratory Analysis
LABORATORY FROTH FLOTATION TESTING	• Fines Floatability • Possible Quality • Reasonable Reagent Requirements	Laboratory Analysis
CQDC COAL-CLEANING EVALUATION	• Actual Yield and Quality Production • Refuse Quality and Characteristics	25 tph Commercial-Scale Cleaning Plant
COMBUSTION CHARACTERISTICS COMPARISON	• Raw Versus Clean Quality • Changes in Slagging Potential • Changes in Fouling Potential • Changes in Grindability • Changes in Moisture and Heating Value • Change in SO_2 Emission Potential	Laboratory Analysis and Theoretical Calculations

GENERAL TESTING METHODOLOGY AND RESULTS

The five segments of a Coal Cleanability Characterization provide data for a Coal Quality Information System entry. EPRI's Coal Quality Information System (CQIS) is a coal-quality database that utilities can use to determine the best available coal to burn in their plants, given their plant characteristics, location, and emissions limits. CQIS includes raw-coal and clean-coal characterizations, liberation data, and combustion characteristics for the more than 35 coals tested at the CQ Inc.'s Coal Quality Development Center (CQDC). Other public information is also being sought for incorporation into the database. CQIS has blending, search/sort, and graphics capabilities.

For this test program, there were two flowsheet tests to determine the extent that impurities can be removed from this coal.

Raw-Coal Characterization

Characterization of the as-received raw coal provides information that can be used to compute slagging and fouling indices and other ash parameters of interest in power plant operations. It also provides the theoretical yield-quality relationships needed to determine improvements achieved by cleaning.

A raw coal sample of approximately seven tons was collected at the CQDC primary sampler located before the crusher. The sample was split into two subsamples. One split was used for raw-coal analysis and the other for liberation testing. Table 2 gives the raw coal analysis.

Tables 3 and 4 give the raw coal and raw coal ash analyses, respectively. As indicated, this raw coal has a medium slagging potential and medium fouling potential based on calculated indices. Raw coal size and composite washability analyses are given in Tables 5 and 6. The raw coal is a high volatile C bituminous coal per ASTM Standard D-388.

The raw coal size analysis shows that the larger size fraction (plus 1 1/2 in.) contains substantial quantities of ash (68.93 percent) and has a very low heating value (3,808 Btu/lb). This is most probably due to the presence of mine roof material in the coal. The mine from which this coal came has a roof formation of shale. The finest fraction analyzed also shows high ash content (61.95 percent) and has low heating value (4,912 Btu/lb). This is in conjunction with

Table 2. Raw-Coal Characterization. *(As-Received Sample)*

Proximate, Sulfur, Btu*	x
Ultimate	x
Sulfur Forms	x
Ash Fusion (reducing and oxidizing)	x
Ash Composition	x
Grindability Index (HGI)	x
Chlorine	x
Size Analysis	
+3-in.	x
3-in. x 1 1/2-in.	x
1 1/2-in. x 3/4-in.	x
3/4-in. x 3/8-in.	x
3/8-in. x 28 mesh	x
28 mesh x 100 mesh	x
100 mesh x 200 mesh	x
200 mesh x 0	x
Ash, Sulfur, Btu* on each size fraction	x
Float/Sink each size fraction at 1.25, 1.30, 1.35, 1.40, 1.60, 1.80, 2.0, 2.45	x
Ash, Sulfur, Btu* on each size/gravity fraction	x

* Heating Value (Btu/lb) - dry basis

Table 3. Raw Coal Analysis. *West Kentucky No. 11 Seam Coal, Union County, Kentucky.*

	As-Received		Dry
PROXIMATE ANALYSIS			
Ash (Wt %)	31.78		35.42
Volatile Matter (Wt %)	26.10		29.10
Fixed Carbon (Wt %)	31.84		35.48
Total Moisture (Wt %)	10.28		---
Heating Value (Btu/lb)	8,094		9,022
Sulfur			
Total (Wt %)	3.39		3.78
Sulfate (Wt %)	0.09		0.10
Organic (Wt %)	1.52		1.70
Pyritic (Wt %)	1.78		1.99
Pyritic/Total (Wt %)		0.53	
SO_2 (lb/MBtu)		8.37	
Ash (lb/MBtu)		39.26	
Hardgrove Grindability Index		52	
Chlorine (Wt %, Dry)		0.08	
Equilibrium Moisture (Wt %)		8.59	
ULTIMATE ANALYSIS (Dry)			
Carbon (Wt %)		49.67	
Hydrogen (Wt %)		3.77	
Nitrogen (Wt %)		1.00	
Sulfur (Wt %)		3.78	
Oxygen (Wt %)		6.36	
Ash (Wt %)		35.42	

Table 4. Raw-Coal Analysis of Ash. *West Kentucky No. 11 Seam Coal, Union County, Kentucky.*

ASH FUSIBILITY (Deg. F) (Reducing/Oxidizing)			
Initial Deformation	2120/2340		
Softening	2175/2395		
Hemispherical	2320/2435		
Fluid	2420/2495		
		Proportion of Total Coal	
	Ash (Wt %)	(Wt %)	lb/ MBtu
ASH COMPOSITION (Dry) (Expressed as Oxides)			
SiO_2	53.54	18.96	21.02
Al_2O_3	21.16	7.49	8.30
Fe_2O_3	10.99	3.89	4.31
CaO	5.95	2.11	2.34
MgO	1.08	0.38	0.42
Na_2O	0.74	0.26	0.29
K_2O	2.60	0.92	1.02
TiO_2	0.82	0.29	0.32
MnO_2	0.03	0.01	0.01
P_2O_5	1.51	0.53	0.59
SO_3	2.32	0.82	0.91
Error	-0.74	-0.24	-0.27
Total	100.00	35.42	39.26
$Fe_2O_3/(CaO + MgO)$		1.56	
Silica Percentage		0.75	
Base/Acid Ratio		0.28	
Ash Type		Eastern	
Slagging Index		1.07	
Classification		Medium	
Fouling Index		0.21	
Classification		Medium	

Table 5. Raw-Coal Size Analysis. *West Kentucky No. 11 Seam Coal, Union County, Kentucky.*

Size		Direct				Cumulative			
Passed	Retained	Weight (Wt%)	Ash (Wt %)	Sulfur (Wt %)	Heating Value (Btu/lb)	Weight (Wt%)	Ash (Wt %)	Sulfur (Wt %)	Heating Value (Btu/lb)
	3-in.	0.57	68.93	3.85	3,808	0.57	68.93	3.85	3,808
3-in.	1 1/2-in.	2.04	39.54	6.22	8,170	2.61	45.93	5.71	7,222
1 1/2-in.	3/4-in.	24.78	31.00	5.75	9,615	27.39	32.42	5.74	9,387
3/4-in.	3/8-in.	22.01	28.58	3.99	10,058	49.40	30.71	4.96	9,686
3/8-in.	28M	42.58	39.27	3.17	8,394	91.98	34.67	4.13	9,088
28M	100M	3.63	23.49	3.90	10,687	95.61	34.25	4.12	9,148
100M	200M	0.97	28.52	4.20	9,443	96.58	34.19	4.13	9,151
200M		3.42	61.95	2.14	4,912	100.00	35.14	4.06	9,006

Table 6. Raw-Coal Composite Washability Analysis. *West Kentucky No. 11 Seam Coal, Union County, Kentucky.*

Specific Gravity		Direct				Cumulative Float			
Sink	Float	Weight (Wt%)	Ash (Wt %)	Sulfur (Wt %)	Heating Value (Btu/lb)	Weight (Wt%)	Ash (Wt %)	Sulfur (Wt %)	Heating Value (Btu/lb)
	1.250	6.21	3.71	2.46	13,884	6.21	3.71	2.46	13,884
1.250	1.300	22.80	5.04	2.68	13,678	29.01	4.76	2.63	13,722
1.300	1.350	19.57	8.62	3.17	13,128	48.58	6.31	2.85	13,483
1.350	1.400	5.79	14.15	3.44	12,208	54.37	7.15	2.91	13,347
1.400	1.600	7.76	21.85	4.17	10,972	62.13	8.98	3.07	13,050
1.600	1.800	3.01	34.04	5.54	8,912	65.14	10.14	3.18	12,857
1.800	2.000	2.50	44.64	6.47	7,237	67.64	11.42	3.30	12,651
2.000	2.450	6.88	70.67	4.36	3,399	74.52	16.89	3.40	11,797
2.450		25.48	87.55	6.16	812	100.00	34.89	4.10	8,998

visual observation that the coal contains large amounts of clay.

The raw-coal characterization, as expected, shows decreasing coal quality with increasing specific gravity. The results of the detailed washability are shown in Figures 1, 2, and 3 for yield, ash, and sulfur versus cumulative float specific gravity, respectively. The complete set of washability data is given in Appendix A. The curves are relatively flat through intermediate specific gravities, showing that cleaning performance will be relatively unchanged at intermediate specific gravities. At low specific gravities, less than 1.4, sulfur does lower slightly, but at the expense of yield.

Ash fusibility and ash composition analyses were also conducted on the raw coal and the clean coal produced from the two flowsheet tests. These analyses provided the data for comparing calculated combustion parameters for the raw coal with the cleaned coals.

Impurities Liberation Potential

Impurities must first be freed from the combustible coal mass before they can be removed by physical coal cleaning processes. Crushing the coal to finer topsizes makes it possible to increase impurities liberation and consequently impurities removal during cleaning.

In this program a sample of West Kentucky No. 11 as-received raw coal was analyzed thoroughly for its physical and chemical properties. Complete size and washability analyses were performed to determine the existing, or as-received, state of liberation. A sample split was also prepared in the laboratory and crushed to topsizes of 1½ in., ¾ in., ⅜ in., 28 mesh, and 100 mesh. These samples underwent size and washability analyses to determine the impact of crushing on the impurities liberation and the yield-quality relationship. The washability analyses for these samples are given in Appendix B.

As shown in Figures 4 and 5, there is very little improvement in the yield or the energy recovery versus ash relationship as the coal is crushed to smaller topsizes, with only a slight improvement in energy recovery versus ash when crushed to minus 100 mesh. This indicates that few ash-forming minerals were liberated by crushing. However, the yield or energy recovery versus sulfur relationships in

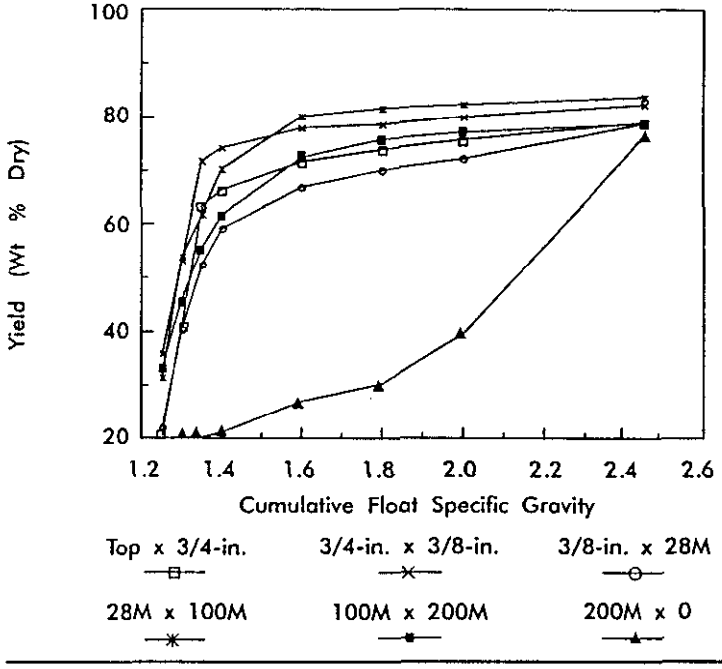


Figure 1. Theoretical Yield Curve. *West Kentucky No. 11 Seam Coal.*

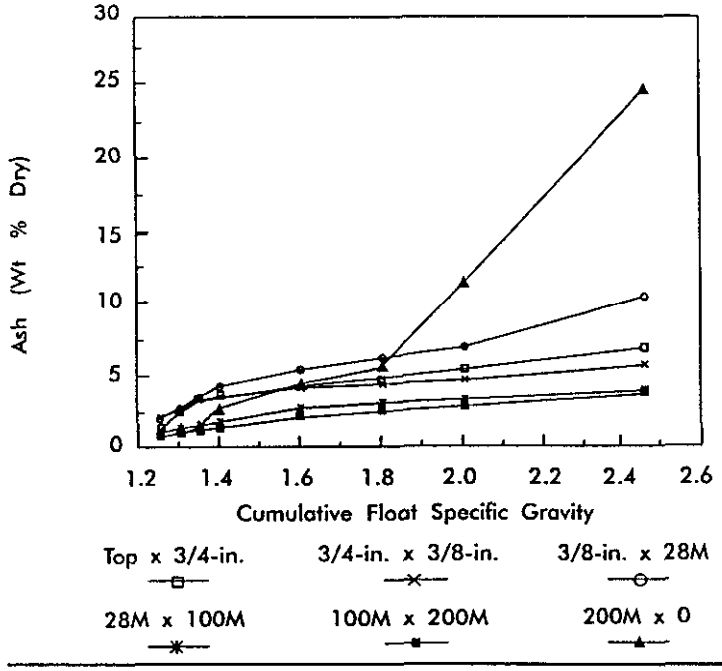


Figure 2. Theoretical Ash Curve. *West Kentucky No. 11 Seam Coal.*

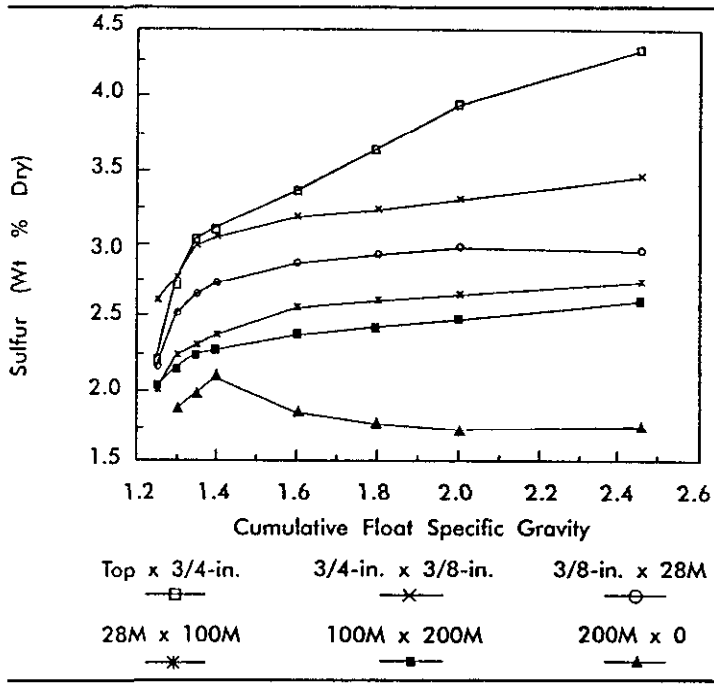


Figure 3. Theoretical Sulfur Curve. *West Kentucky No. 11 Seam Coal.*

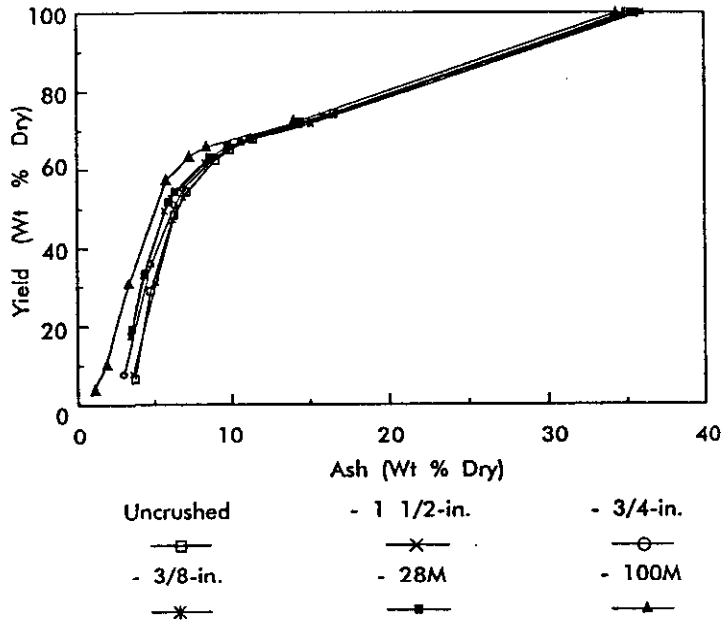


Figure 4. Ash Liberation Potential. *West Kentucky No. 11 Seam Coal.*

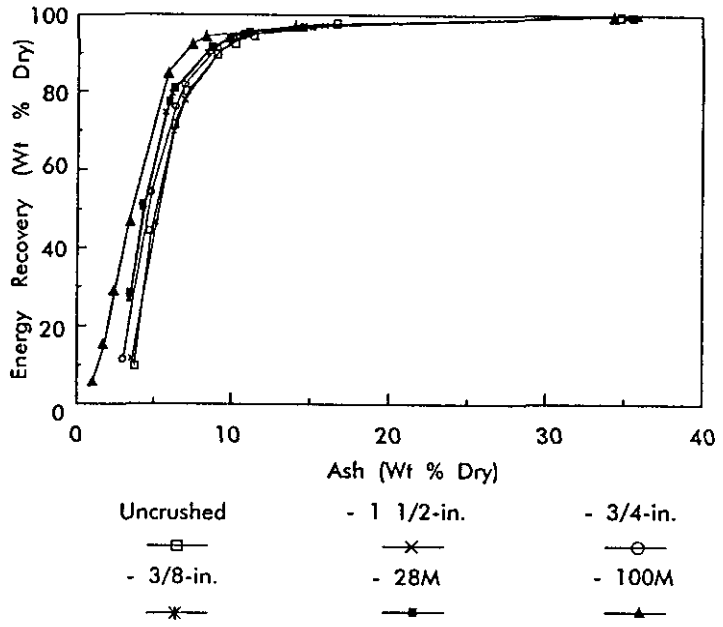


Figure 5. Ash Liberation Potential. *West Kentucky No. 11 Seam Coal.*

Figures 6 and 7 show a slight improvement when crushed to ¾ in. and smaller, with larger improvements when crushed to 100 mesh. For example, at 2.75 percent sulfur, the uncrushed coal has an energy recovery of approximately 60 percent. When crushed to 28 mesh, the coal has an energy recovery of 70 percent with 2.75 percent sulfur. When crushed to 100 mesh, the energy recovery increases to over 95 percent at 2.75 percent sulfur. The sulfur level remains relatively high, indicating that pyritic sulfur is liberated through crushing but the organic sulfur, as expected, is not.

Any liberation caused by crushing leads to higher possible yields at any quality level. However, the benefits of this increased yield may not be found in practice since cleaning efficiency tends to fall with particle size. Also, finer clean coal is likely to have a higher moisture content that will negate some of the benefits of increased liberation. The handleability of the coal also becomes a concern when dealing with fine sizes.

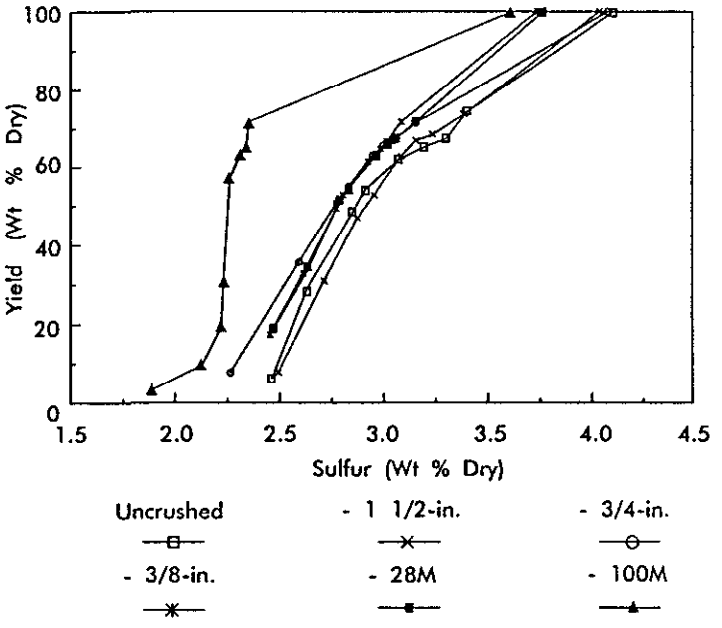


Figure 6. Sulfur Liberation Potential. *West Kentucky No. 11 Seam Coal.*

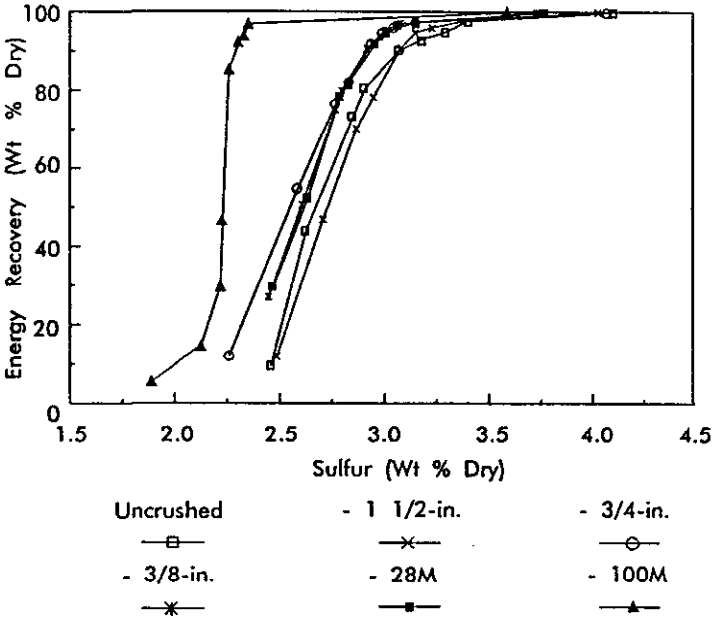


Figure 7. Total Sulfur Liberation Potential. *West Kentucky No. 11 Seam Coal.*

Laboratory Froth Flotation Testing

Laboratory froth flotation testing was performed in a WEMCO 3.5 liter laboratory flotation cell equipped with an automatic skimmer. In the test program laboratory froth flotation work was limited to raw coal crushed to 100 mesh. Laboratory froth flotation work was limited to this size fraction because of parallel work also being done on this coal using advanced cleaning methods that crush the coal to very fine sizes (minus 400 mesh).

Since this coal has a fairly high ash content (50.56 percent) in the minus 325 mesh size fraction, only the 100 mesh x 325 mesh size fraction was investigated. The investigation was conducted at a five weight percent solids concentration. The other operating conditions of this test work are given at the bottom of Table 7.

Eleven tests were performed at various frother (MIBC) and collector (No. 2 fuel oil) dosages. Froth concentrates (clean coal) were collected over a time interval of 240 seconds. Each concentrate was dried, weighed, and analyzed for ash and form of sulfur. The first three tests show that collector is required to float this coal as indicated by poor yield and ash reduction. Figures 8 and 9 show that in tests 7, 8, and 9 as frother (MIBC) increased yield increased, but ash and sulfur generally decreased, indicating that the optimum dosage of frother was at or near the upper limit of the test work. Figures 8 and 9 also show that in tests 4, 6, and 9 as collector increased yield also increased, but ash and sulfur content increased as collector levels increased to 0.25 lb/ton and then decreased as dosages increased higher. Decreasing ash and sulfur content with collector dosages higher than 0.25 lbs/ton indicate that the optimum dosage may have not been reached in this test work and indicates further test work would be required to further optimize the collector dosage. Ash content level of 6.5 percent and sulfur content of 3.08 percent were achieved at an acceptable yield of 85.1 percent with collector and frother dosages of 0.50 lbs/ton each.

In order to establish the relationships between retention time and both yield and product quality, froth concentrations were collected at timed intervals of 0 to 60 seconds, 60 to 120 seconds, and 120 to 240 seconds for all tests. The flotation time-recovery curves for the 100 mesh x 325 mesh raw coal test with best ash efficiency are shown in

Table 7. Laboratory Froth Flotation Results. *For fines from crushed to 100M raw coal, 100M x 325M size fraction. West Kentucky Seam Coal (Dry Basis).*

Test No.	Reagent Dosage (lb/t) MIBC Frother	Reagent Dosage (lb/t) No. 2 Fuel Oil Collector	Stream	Quality Ash (Wt %)	Quality Total Sulfur (Wt %)	Performance Yield (Wt %)	Performance Comb. Recovery (%)	Performance Ash Removal (Wt %)	Performance Sulfur Removal (Wt %)	Performance Ash* Separ Effic.
			Feed (all tests)	15.7	4.00	100.0	100.0	0.0	0.0	0.0
1	0.15	0.00	Clean Coal	15.7	4.41	13.2	13.2	86.9	85.5	0.0
			Refuse	15.7	3.9	86.8				
2	0.25	0.00	Clean Coal	13.8	3.72	13.9	14.2	87.8	87.8	2.1
			Refuse	16.1	4.0	86.1				
3	0.50	0.00	Clean Coal	12.4	3.38	22.7	23.5	82.1	80.9	5.7
			Refuse	16.7	4.2	77.4				
4	0.50	0.15	Clean Coal	5.5	2.83	64.0	71.7	77.7	54.7	49.4
			Refuse	33.9	6.1	36.0				
5	0.25	0.25	Clean Coal	8.0	3.15	40.7	44.4	79.3	68.0	23.6
			Refuse	21.0	4.6	59.3				
6	0.50	0.25	Clean Coal	8.9	3.20	75.4	81.5	57.5	39.7	39.0
			Refuse	36.8	6.5	24.6				
7	0.15	0.50	Clean Coal	10.1	3.41	47.9	51.1	69.4	59.2	20.5
			Refuse	21.0	4.5	52.1				
8	0.25	0.50	Clean Coal	7.2	3.02	61.3	67.4	71.8	53.7	39.3
			Refuse	29.2	5.5	38.7				
9	0.50	0.50	Clean Coal	6.5	3.08	85.1	94.4	64.9	34.5	59.3
			Refuse	68.5	9.3	14.9				
10	0.25	0.25	Clean Coal	7.2	3.06	41.9	46.2	80.8	76.9	27.0
			Refuse	21.9	4.7	58.1				
11	0.25	0.25	Clean Coal	7.1	3.09	41.1	45.3	81.5	68.2	26.9
			Refuse	21.8	4.6	58.9				

* Ash Separation Efficiency = Combustibles Recovery - (100 - Ash Removal)

Notes:
-- The tests used a WEMCO 3.5-liter laboratory flotation cell with an automatic skimmer.
-- Standard Test Conditions:

Solids (Wt %)	5	Wetting Time (min)	10	Rotor Speed (r/m)	1,200	Conditioning Time (m:s)	2:00
Slurry pH	6-8	Aeration Rate (scfm)	35	Skimmer Speed (r/m)	20	Collection Time (m:s)	4:00

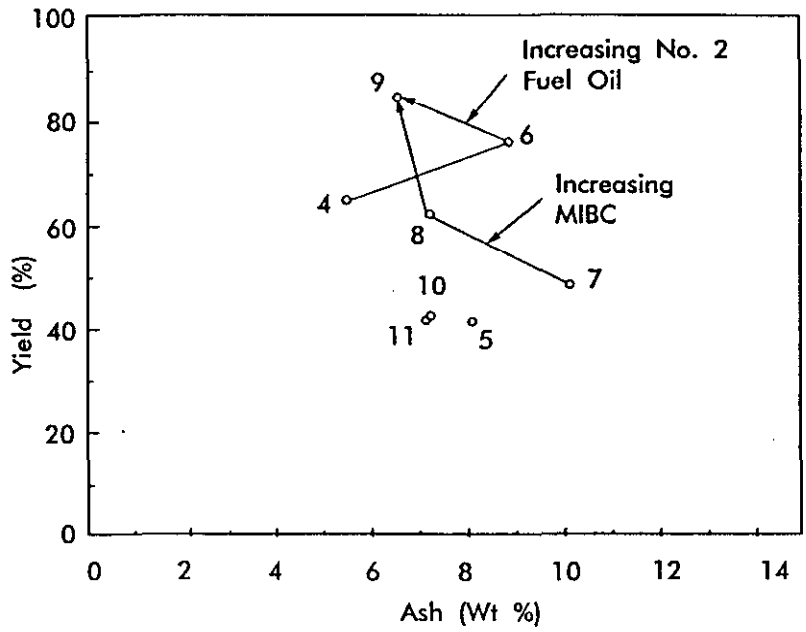


Figure 8. Laboratory Froth Flotation Results. *West Kentucky No. 11 Seam Coal.*

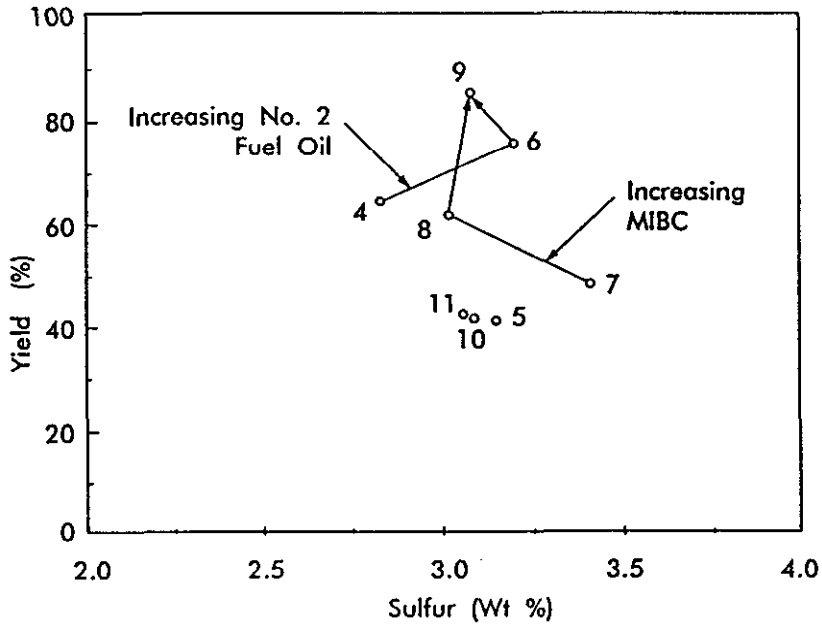


Figure 9. Laboratory Froth Flotation Results. *West Kentucky No. 11 Seam Coal.*

Figure 10. For the purpose of this figure, recovery is defined as the portion of the total material present in the feed that is recovered in the concentrate. For example, the 100 mesh x 325 mesh feed coal contains 4.00 percent sulfur. During flotation rate tests it was found that over the interval of 0 to 60 seconds, 83.29 percent by weight of the coal reported to the product (floated) and this product coal had a sulfur content of 3.08 percent. At 60 seconds, sulfur recovery for this test is 64.13 percent ([0.8329 x 3.08]/4.00).

Figure 10 indicates that the combustibles, the ash, and the sulfur recoveries follow the solids recoveries (yield). All curves show no increase with time past 120 seconds with virtually all of the recovery taking place within the first 60 seconds of flotation.

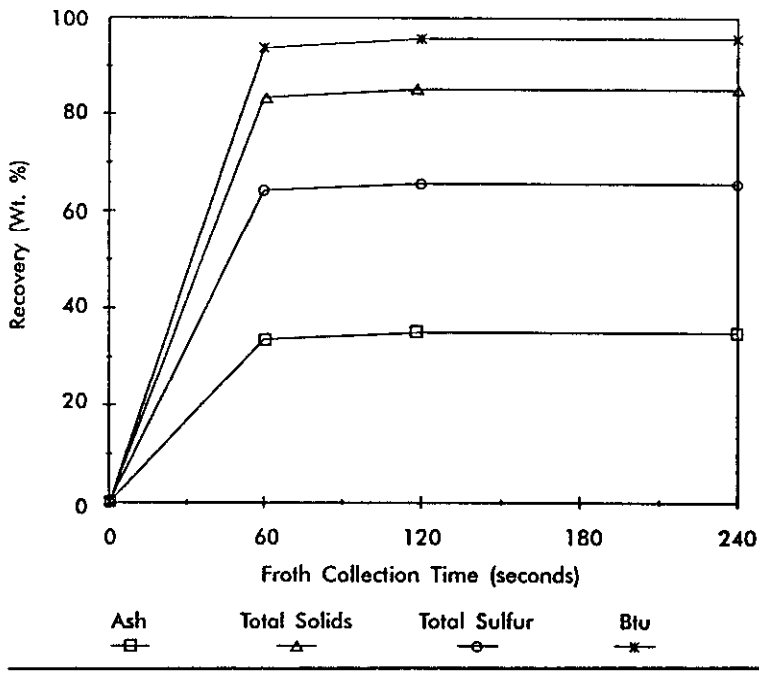


Figure 10. Flotation Rates. *West Kentucky No. 11 Seam Coal.*

Coal-Cleaning Evaluation

Two commercial-scale tests were conducted at the CQDC with the West Kentucky No. 11 Seam coal. The flowsheet is shown in Figure 11. The heavy-media cyclone (HMC), water-only cyclone (WOC), and rougher-only froth flotation

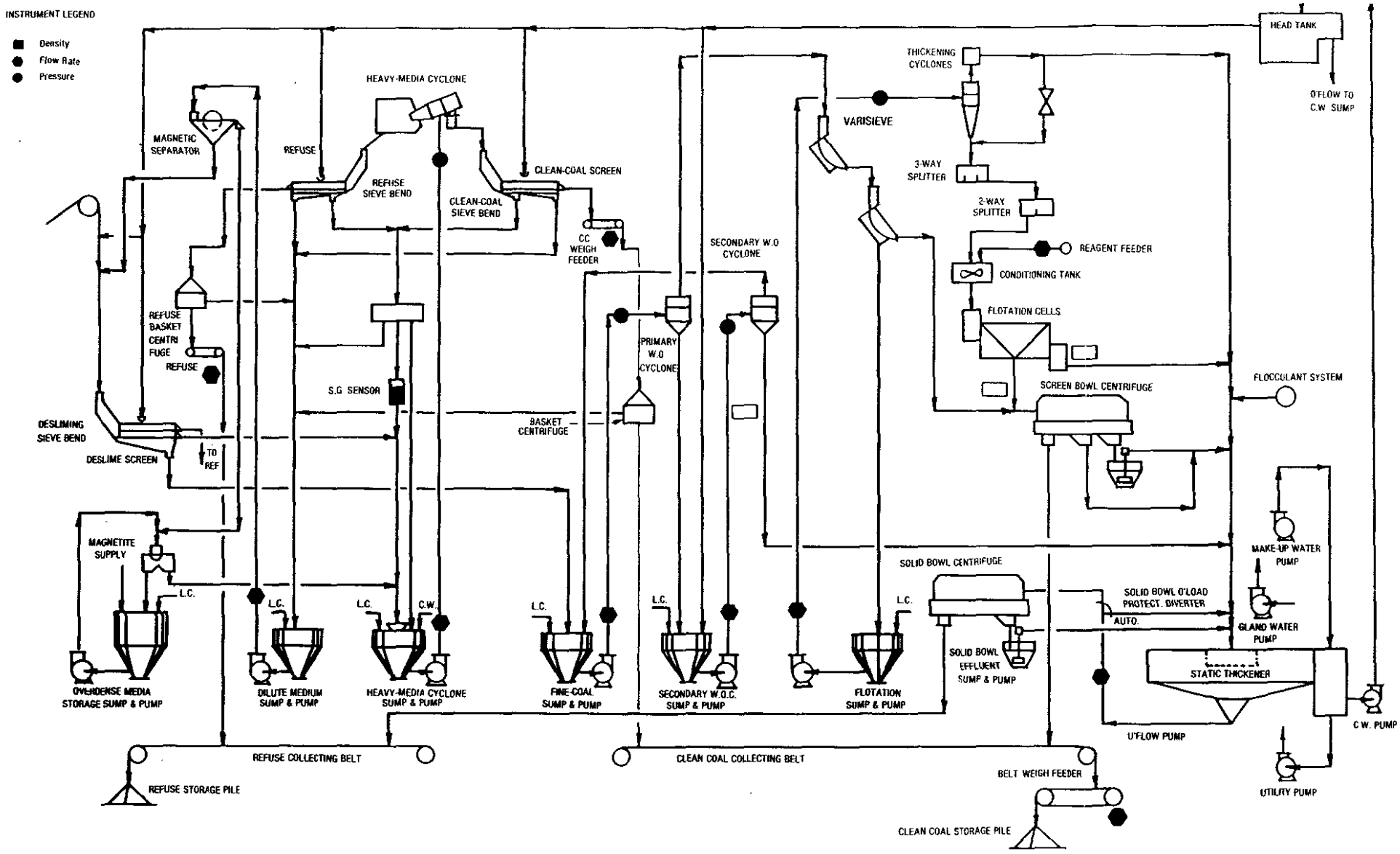


Figure 11. *Heavy-Media Cyclone, Water-Only Cyclone, Froth Flotation Flowsheet.*

(FF) flowsheet was chosen based on typical coal cleaning practices and the test objectives. In the first test, the coal was crushed to 3/4-in. topsize. A low separating gravity was used to produce a high-quality, high-Btu clean coal. The heavy-media circuit circulating gravity was set at 1.4 specific gravity and the water-only cyclone geometry was set to give a high gravity separation. A high reagent dosage in the froth flotation circuit was set to assure a high yield product. In the second flowsheet test the raw coal was crushed to 3/8-in. and a lower separating gravity was chosen to determine if a clean coal with an ash level comparable to the commercial plant could be achieved at a higher yield. In this test, the raw coal was crushed to a 3/8-in. topsize to liberate impurities at a possible increase in yield. The heavy-media circuit circulating gravity was set at 1.36 specific gravity. The water-only cyclone geometry remained the same as in the first flowsheet test. Froth flotation reagent rate (lbs/ton) was decreased as a result of additional fines created from crushing to a smaller topsize.

Heavy-media cycloning was selected to clean the topsize x 28 mesh fraction because this is a typical cleaning process used for this size fraction. Heavy-media processes will generally produce the highest yield at a given coal quality. Water-only cyclones were selected for cleaning the 28 mesh x 100 mesh fraction of this coal because of their potential for removing fine liberated pyrite. The 100 mesh x 325 mesh fraction was cleaned by froth flotation. Minus 325 mesh coal was removed ahead of froth flotation and discarded as refuse.

Flowsheet tests were conducted to determine the extent that this coal can be economically cleaned and to provide clean coal samples for a laboratory combustion characteristics analysis. The clean coal laboratory combustion characteristics then were compared to the raw coal characteristics to determine the effect of coal quality on certain important combustion characteristics such as slagging, fouling, and SO_2 emissions potential. These tests provided data on two clean coals (medium- and deep-cleaned West Kentucky No. 11) to be entered into CQIS.

Heavy-Media Cyclone Performance

The performance of the heavy-media cyclone unit operation for both flowsheet tests is summarized in Table 8.

Table 8. Heavy-Media Cyclone Unit Performance. *Kentucky No. 11 Seam Coal, Union County, Kentucky (Dry Basis).*

	Test 1			Test 2		
CONDITIONS						
Coal Size Fed	3/4-in. x 0			3/8-in. x 0		
Feed Rate (dry t/h)	17.5			11.2		
Feed Pressure (psig)	14.4			14.9		
CYCLONE GEOMETRY						
Body Diameter (in.)	14			14		
Orifice Diameters:						
Feed (in.)	4 x 2-3/4			4 x 2-3/4		
Overflow (in.)	6			6		
Apex (in.)	5			5		
Cone Angle (°)	20			20		
Mounting Angle (°)	10			10		
PERFORMANCE						
Circulating (Sp Gr)	1.40			1.36		
Yield (Wt %)	63			53		
Energy Recovery (%)	89			75		
Ash Removal (Wt %)	88			90		
Total Sulfur Removal (Wt %)	58			72		
QUALITY (Dry Basis)	Feed	Clean Coal	Refuse	Feed	Clean Coal	Refuse
Ash (Wt %)	30.67	5.79	72.80	30.56	5.10	58.81
Total sulfur (Wt %)	4.21	2.79	6.57	4.54	2.79	6.95
Heating Value (Btu/lb)	9,724	13,684	3,149	9,696	13,722	5,051
SO_2 Emission Potential (lb/MBtu)	8.65	4.07	41.69	9.36	4.06	27.49

Note: The cyclone was made by Roberts & Schaefer Company, Inc., under an original Dutch State Mines license.

Performance of the heavy-media cyclone was as expected, with yield and energy recovery decreasing with decreasing circulating gravity. This caused an increase in ash and sulfur removal. For example, Test No. 1 (1.40 specific gravity) compared with Test No. 2 (1.36 specific gravity) shows a decrease from 63 to 53 percent yield and 89 to 75 percent energy recovery, respectively. However, the total clean coal produced in Test 2 (see Table 11) shows no substantial reduction in ash (5.21 versus 6.37) or sulfur (2.78 versus 2.92) from crushing the topsize to 3/8 in. This follows the results shown in Figures 4 through 6, which show little potential for liberation until coal is crushed to 100 mesh.

Water-Only Cyclone Performance

A two-stage water-only cyclone configuration, which consisted of a 10-in. primary cyclone and a 6-in. secondary cyclone, was used in the two flowsheet tests. The two-stage configuration re-cleaned the underflow from the primary cyclone in the secondary cyclone. Overflow from the secondary cyclone, containing misplaced coal from the primary cyclone, was recycled to the primary cyclone for recleaning. The product from this circuit was the primary cyclone overflow.

The performance of the two-stage water-only cyclone unit in both flowsheet tests is shown in Table 9. Similar quality products were achieved in both tests, producing a high yield (83 percent and 88 percent) even with the water-only cyclone circuit feed rate in Test 2 increased 49 percent. Water-only cyclone circuit feed rate in Test 2 increased even though the plant feed rate was decreased by 25 percent in anticipation of increased fines caused by crushing to 3/8-in. topsize.

Froth Flotation Performance

Plant froth flotation cell performance is summarized in Table 10. As expected, the high clay content of this coal prevents high yields of the froth flotation cells. High energy recovery of both tests (93 and 95 percent) indicate that a large amount of carbonaceous matter was recovered. Test 2 showed a slight increase in yield (61 percent compared to 54 percent in Test 1). This can be explained by looking at the feed ash content. A lower feed ash (41.39 percent) in Test 2 compared to 47.33 percent in Test 1 indicated that there was more floatable material in Test 2 than in Test 1. High collector dosages (3.89 lb/t) and frother dosage (0.98 lb/t) in Test 1 were the results of overestimating the feed rate

Table 9. Water-Only Cyclone Unit Performance. *Kentucky No. 11 Seam Coal, Union County, Kentucky (Dry Basis).*

	Test 1		Test 2	
CONDITIONS	Primary	Secondary	Primary	Secondary
Coal Size Fed	28M x 0	28M x 0	28M x 0	28M x 0
Coal Size Cleaned	28M x 100M	28M x 100M	28M x 100M	28M x 100M
New Feed Rate (dry t/h)	2.53	N/D	3.78	N/D
Feed Pressure (psig)	14.2	14.9	14.3	N/D
CYCLONE GEOMETRY				
Body Diameter (in.)	10	6	10	6
Orifice Diameters:				
Feed (in.)	4	2-1/2	4	2-1/2
Overflow (in.)	4	3	4	3
Apex (in.)	2	3/4	2	3/4
Vortex Finder (in.)	13-1/4	7-1/2	13-1/4	7-1/2
Cone Angle (°)	75	75	75	75
PERFORMANCE				
Yield (Wt %)	83		88	
Energy Recovery (%)	91		89	
Ash Removal (Wt %)	24		16	
Total Sulfur Removal (Wt %)	40		30	

		Clean			Clean	
QUALITY (Dry Basis)	Feed	Coal	Refuse	Feed	Coal	Refuse
Ash (Wt %)	46.32	42.62*	65.03	46.19	44.23	60.80
Total sulfur (Wt %)	3.00	2.16*	7.07	3.22	2.37	7.94
Heating Value (Btu/lb)	7,267	7,996*	3,709	7,221	7,305	4,621
SO_2 Emission Potential (lb/MBtu)	8.25	5.43	38.09	8.91	6.48	34.33

* In Test 1 the ash, sulfur, and Btu values were mathematically determined.

Note: The primary and secondary cyclones were made by Krebs Engineers.

Table 10. CQDC Plant Froth Flotation Cells Unit Performance. *Kentucky No. 11 Seam Coal, Union County, Kentucky (Dry Basis).*

	Test 1			Test 2		
CONDITIONS						
Coal Size Feed	100M x 325M			100M x 325M		
Feed Rate (dry t/h)	0.28			0.71		
Feed Solids (Wt %)	3.50			5.83		
Conditioning Time (min)	N/D			N/D		
Retention Time (min)	9.5			6.1		
Reagent Dosages (lb/t):						
Fuel Oil Collector	3.89			1.49		
MIBC Frother	0.98			0.37		
PERFORMANCE						
Yield (Wt %)	54			61		
Energy Recovery (%)	93			95		
Ash Removal (Wt %)	83			82		
Total Sulfur Removal (Wt %)	42			37		
QUALITY (Dry Basis)	Feed	Clean Coal	Refuse	Feed	Clean Coal	Refuse
Ash (Wt %)	47.33	14.65	85.06	41.39	12.20	87.19
Total Sulfur (Wt %)	3.29	3.69	2.97	3.60	3.67	3.40
Heating Value (Btu/lb)	7,113	12,229	1,209	8,103	12,572	1,157
SO_2 Emission Potential (lb/MBtu)	9.24	6.03	49.10	8.88	5.83	58.71

Note: The conditioning tank is 21 cu-ft and there are four 10 cu-ft cells in a bank. The cells are made by Hazen-Quinn Equipment Company.

(less minus 100 mesh material) to the cells. Also, at the conclusion of Test 1 it was discovered that during the test, two out of eight thickening cyclones plugged thus further reducing the flow to the froth cells by 25 percent.

The sulfur removals were the best that can be expected considering the high organic sulfur contained in this coal.

The ash removals are as expected, with high ash removals at low yield because of high clay content of this coal. The low sulfur removals can be attributed to the limited effectiveness of froth flotation to reduce sulfur because organic sulfur tends to concentrate in the clean coal and the pyritic sulfur will often float and report to product.

Flowsheet Performance Comparison

The overall results for the two flowsheet tests are shown in Table 11. Data for the raw coal feed, clean coal product, and flowsheet performance are given in the table. These test results show that lowering ash content sacrifices higher yield. Generally, as yield increases, energy recovery increases at the expense of clean coal quality. Test No. 2, with a yield of 48 percent and an energy recovery of 73 percent, has lower ash (5.21 percent) and sulfur (2.78 percent). Test No. 2 flowsheet--when crushing the feed to 3/8-in. topsize--indicated, as did the raw coal liberation study, that no increase in yield occurred from the impurities being liberated.

In comparing the CQDC flowsheet tests to commercial plant performance, both CQDC flowsheet tests produced lower ash content coal than the commercial plant. Sulfur content of the coal in Test 1 was slightly higher; in Test 2 the sulfur content was slightly lower. Test 1 produced coal with lower ash content than the commercial plant at a slightly higher yield (59 percent compared to 55 percent) as reported by commercial plant personnel. Test 2 showed, as expected, lower yield at lower ash content than the commercial plant. The higher yield and lower ash content of Test 1 can be explained by some liberation occurring when crushing to ¾ in. The commercial plant cleans coal at a larger topsize (4-in.) and in the CQDC Test 1 the topsize was reduced to ¾ in. If this is the case the commercial plant can improve its yield by reducing topsize. However, to clean coal at a smaller topsize the commercial plant has to

Table 11. Flowsheet Performance Comparison. *West Kentucky No. 11 Seam Coal, Union County, Kentucky (Dry Basis, Except Moisture).*

	HMC, WOC, FF Flowsheet (Test 1)	HMC, WOC, FF Flowsheet (Test 2)
RAW COAL		
Feed Rate (Wet t/h)	20	15
Coal Size	3/4-in. x 0	3/8-in. x 0
Total Moisture (Wt %)	10.28	11.05
Ash (Wt %)	32.65	34.50
Sulfur (Wt %)	3.69	4.33
Pyritic Sulfur (Wt %)	2.50	2.84
Organic Sulfur (Wt %)	1.11	1.36
Sulfate Sulfur (Wt %)	0.07	0.13
Heating Value (Btu/lb)	9,540	9,074
SO_2 Emission Potential (lb/MBtu)	7.73	9.53
CLEAN COAL		
Total Moisture (Wt %)	10.86	12.50
Ash (Wt %)	6.37	5.21
Total Sulfur (Wt %)	2.92	2.78
Pyritic Sulfur (Wt %)	0.90	0.77
Organic Sulur (Wt %)	2.00	1.99
Sulfate Sulfur (Wt %)	0.02	0.02
Heating Value (Btu/lb)	13,584	13,777
SO_2 Emission Potential (lb/MBtu)	4.29	4.03
PERFORMANCE		
Yield (Wt %)	59	48
Energy Recovery (%)	84	73
Ash Removal (Wt %)	88	93
Total Sulfur Removal (Wt %)	53	69
Ash Reduction (%)	80	85
SO_2 Reduction (%)	45	58

Note: HMC - Heavy Media Cyclone
WOC - Water-Only-Cyclone
FF - Froth Flotation

be able to handle the additional fines caused by crushing to a smaller topsize.

Combustion Characteristics Comparison

Combustion characterization consists of laboratory analyses that can be used to compare the changes in combustion characteristics brought about by cleaning. These analyses include:

- Proximate Analysis
- Ultimate Analysis
- Heating Value
- Hardgrove Grindability Index
- Ash Constituents
- Ash Fusibility (Oxidizing and Reducing Atmospheres)
- Chlorine Analysis

Laboratory combustion characterizations were performed for the raw coal, the clean coal from both flowsheet tests conducted at the CQDC, and the commercially cleaned coal sampled at the Watson Generating Station.

The results of the combustion characteristics comparison based on laboratory analyses of the West Kentucky No. 11 Seam raw coal, the two clean coals from the flowsheet tests, and the commercially cleaned coal sampled at the Watson Generating Station are presented in Table 12. Also included in the table are calculated indices comparing coal ash characteristics resulting from combustion.

Proximate Analysis. A proximate analysis is used to help characterize how a coal reacts when it is heated; that is, how much of the coal is released as a gas and vapors (volatile matter) and the quantity that remains as fixed carbon and ash. Also, a proximate analysis usually quantifies the amount of ash and sulfur in the ash. As shown in Table 12 cleaning significantly decreased ash content in all three cleaning processes. Ash decreased from a raw coal value of 35.4 percent to 6.4 percent in Test 1, and to 5.2 percent in Test 2. For the commercially cleaned coal sample collected at Watson Generating Station the ash was reduced to 6.9 percent.

Table 12. Combustion Parameters Comparison. *West Kentucky No. 11 Seam Coal, Union County, Kentucky (As-Received, Dry Basis, Except Moisture).*

	Raw Coal	Test 1 Clean Coal	Test 2 Clean Coal	Field Test Clean Coal
Yield (Wt %)	100.0	59	48	n/a
Energy Recovery	100.0	84	73	53-55*
Total Moisture (Wt %)	10.3	10.9	12.5	11.7
PROXIMATE ANALYSIS				
Ash (Wt %)	31.8 / 35.4	5.7 / 6.4	4.6 / 5.2	6.1 / 6.9
Volatile Matter (Wt %)	26.1 / 29.1	37.7 / 42.3	37.6 / 42.9	35.8 / 40.5
Fixed Carbon (Wt %)	31.8 / 35.5	45.7 / 51.3	45.4 / 51.9	46.6 / 52.6
Total Sulfur (Wt %)	3.39 / 3.78	2.60 / 2.92	2.43 / 2.78	2.53 / 2.86
Pyritic Sulfur (Wt %)	1.78 / 1.99	0.80 / 0.90	0.67 / 0.77	0.63 / 0.71
Pyritic/Total (%)	52.6	30.8	27.7	24.8
Heating Value (Btu/lb)	8094/9022	12109/13584	12054/13777	11821/13381
MAF Heating Value (Btu/lb)	13970	14,508	14534	14374
Chlorine (Wt %)	0.07 / 0.08	0.14 / 0.16	0.35 / 0.40	0.20 / 0.23
SO_2 (lb/MBtu)	8.38	4.30	4.04	4.27
Hardgrove Grindability Index (HGI)	52	49	47	52.5
ULTIMATE ANALYSIS (Dry Basis)				
Carbon (Wt %)	49.7	74.7	75.4	74.4
Hydrogen (Wt %)	3.8	5.3	5.5	5.1
Nitrogen (Wt %)	1.0	1.5	1.4	1.4
Oxygen (Wt %)	6.4	9.3	9.7	9.2
ASH FUSIBILITY (°F) (Reducing/Oxidizing)				
Initial Deformation	2120/2340	1945/2415	1960/2420	1979/2373
Softening	2175/2395	2040/2470	2005/2480	2030/2421
Hemi-Spherical	2320/2435	2200/2505	2140/2525	2131/2465
Fluid	2420/2495	2300/2570	2300/2560	2300/2509

* Not the same raw coal used to calculate cleaning performance.

Table 12. Combustion Parameters Comparison (continued). *West Kentucky No. 11 Seam Coal, Union County, Kentucky (As-Received, Dry Basis, Except Moisture).*

	Raw Coal			Test 1 Clean Coal			Test 2 Clean Coal			Field Test Clean Coal		
	Proportion of:			Proportion of:			Proportion of:			Proportion of:		
	Dry Ash (%)	Dry Coal (%)	(lb/MBtu)	Dry Ash (%)	Dry Coal (%)	(lb/MBtu)	Dry Ash (%)	Dry Coal (%)	(lb/MBtu)	Dry Ash (%)	Dry Coal (%)	(lb/MBtu)
ASH COMPOSITION												
Mineral:												
SiO_2	53.54	18.96	21.02	46.05	2.93	2.16	45.83	2.39	1.73	45.77	3.16	2.36
Al_2O_3	21.16	7.49	8.31	19.77	1.26	0.93	20.08	1.05	0.76	18.91	1.31	0.98
Fe_2O_3	10.99	3.89	4.31	24.46	1.56	1.15	23.86	1.24	0.90	21.09	1.46	1.09
CaO	5.95	2.11	2.34	3.73	0.24	0.17	2.99	0.16	0.11	4.67	0.32	0.24
MgO	1.08	0.38	0.42	0.80	0.05	0.04	0.74	0.04	0.03	0.76	0.05	0.04
Na_2O	0.74	0.26	0.29	0.87	0.06	0.04	1.08	0.06	0.04	0.79	0.05	0.04
K_2O	2.60	0.92	1.02	2.18	0.14	0.10	1.91	0.10	0.07	2.09	0.14	0.11
TiO_2	0.82	0.29	0.32	1.23	0.08	0.06	1.28	0.07	0.05	0.75	0.05	0.04
MnO_2	0.03	0.01	0.01	0.04	0.00	0.00	0.04	0.00	0.00	0.04	0.00	0.00
P_2O_5	1.51	0.53	0.59	0.25	0.02	0.01	0.13	0.01	0.00	0.19	0.01	0.01
SO_3	2.32	0.82	0.91	2.23	0.14	0.10	1.95	0.10	0.07	4.10	0.28	0.21
Unknown	*-0.74*	*-0.26*	*-0.29*	*-1.61*	*-0.10*	*-0.08*	*0.11*	*0.01*	*0.00*	*0.84*	*0.06*	*0.04*
	100.00	35.42	39.26	100.00	6.37	4.69	100.00	5.21	3.78	100.00	6.91	5.16
CALCULATED INDICES												
Silica Ratio		0.75			0.61			0.62			0.63	
Base-to-Acid Ratio		0.28			0.48			0.46			0.45	
Ash (lb/MBtu)		39.3			4.69			3.8			5.2	
Slagging Index (Rs)		1.07			1.40			1.27			1.29	
Classification		Medium			Medium			Medium			Medium	
Fouling Index (Rf)		0.21			0.42			0.49			0.35	
Classification		Medium			Medium			Medium			Medium	
Critical Viscosity												
Temperature (°F)		*2455*			*2210*			*2205*			*2265*	
Slag Viscosity* (Poise)												
at 2,300°F		3063			496			584			644	
at 2,600°F		304			51			58			66	

* Calculated values; ash viscosity data was not experimentally determined.

Slagging Index Classiciation	
Low	Rs < 0.6
Medium	0.6 < Rs < 2.0
High	2.0 < Rs < 2.6
Severe	2.6 < Rs

Fouling Index Classification	
Low	Rf < 0.2
Medium	0.2 < Rf < 0.5
High	0.5 < Rf < 1.0
Severe	1.0 < Rf

Ultimate Analysis. Among other things, an ultimate analysis summarizes the organic constitutes of the coal and is a convenient and uniform method of comparing coals. An ultimate analysis also is required by boiler operators for air requirements, heat losses, and weight of products of combustion. As with the proximate analysis, cleaning produces some significant changes. A large reduction in percent ash caused an approximately 50 percent increase in carbon, hydrogen, nitrogen, and oxygen.

Heating Value. Heating value increased as expected with coal cleaning. Heating value (dry basis) increased from 9022 Btu/lb for the raw coal to clean coal values of 13,584 Btu/lb from Test 1, 13,777 Btu/lb from Test 2, and 13,381 Btu/lb for the commercially cleaned coal sample collected at Watson Generating Station.

Hardgrove Grindability Index. Hardgrove Grindability Index (HGI) is a measurement of how well a coal can be pulverized in a pulverizer as compared to a reference coal. For this coal, the Hardgrove Grindability Index did not change appreciably when cleaned. In fact, the changes were within the ASTM accepted repeatability limits of ASTM's test. However, the reduction in pyrite from 1.99 percent in the raw coal to 0.90 percent, 0.77 percent, and 0.71 percent in the cleaned coals should improve pulverizer performance slightly. Also, the increased heating value resulting from the cleaning will decrease the energy required by the pulverizer by decreasing the amount of coal required to be pulverized.

Ash Constituents. Coal cleaning can affect ash constituents, potentially changing the behavior of ash in a boiler. However, as Table 12 shows, coal cleaning did not significantly change the weight percent of most of the ash constituents during this characterization. Graphical representations of the ash constituents are shown in Figures 12 and 13. In contrast, and of particular interest to power generating companies, are the concentrations of iron and sodium in the ash, both of which increased with this coal when cleaned. Increased concentrations of iron and sodium cause a slight increase in the slagging and fouling index as shown in Table 12. However the lbs/MBtu of iron and sodium decreased as shown in Table 12, from 4.31 lbs/MBtu in the raw coal to a low of 0.90 lbs/MBtu in Test 2. The Na_20 decreased from 0.29 lbs/MBtu in the raw

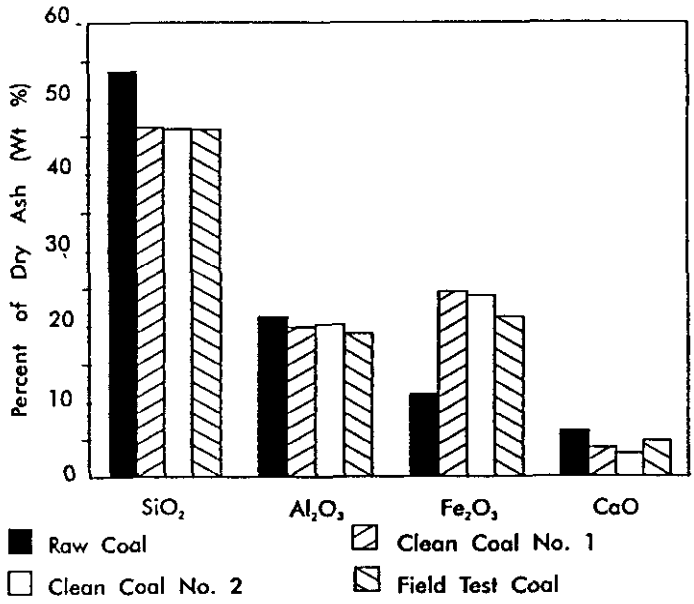


Figure 12. Ash Composition. *Raw and Clean Coal Comparison, West Kentucky No. 11 Seam Coal.*

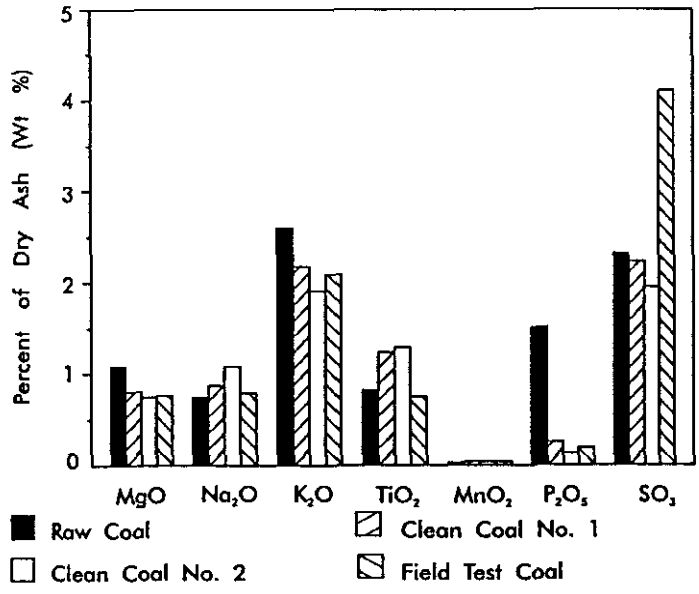


Figure 13. Ash Composite. *Raw and Clean Coal Comparison, West Kentucky No. 11 Seam Coal.*

coal to 0.04 lbs/MBtu in all three clean coals. With these decreases in lbs/MBtu the boiler would see much less ash overall. These elements, when in sufficient quantities, can contribute to boiler slagging and fouling but in this case should cause only a slight increase in slagging and fouling potential.

Although there was no great reduction in ash concentrations, the ash loading is significantly reduced with cleaning, decreasing from 39.26 lb ash/MBtu to 4.13, 3.78, and 5.84 lb ash/MBtu in the clean coals.

CONCLUSIONS

The following conclusions may be made about the West Kentucky No. 11 Seam coal based on the results of this test program:

- The raw coal characterization indicates that the West Kentucky No. 11 Seam coal has a medium slagging and fouling index. The SO_2 emissions potential for the raw coal is 8.38 lb/MBtu and the ash loading is 39.26 lb/MBtu. The West Kentucky No. 11 Seam coal is ranked by ASTM criteria as a high volatile C bituminous coal and has a dry volatile content of 29 percent.

- The impurities liberation investigation indicates that there is a general trend in ash liberation as the raw coal is crushed to finer topsizes, but no large ash liberation occurs in the coal crushed to any size investigated. Sulfur-bearing minerals are liberated to some extent when the raw coal is crushed to 100 mesh. These results are consistent with cleaning tests performed at the CQDC on 3/4 in. coal. The results are also consistent with commercially cleaned coal at 4-in. topsize. CQDC clean coal showed slightly higher yield (59 percent versus 53-55 percent reported by plant personnel) at slightly lower ash contents (6.4 percent versus 6.9 percent).

- The Coal Cleaning Evaluation and Combustion Characteristics Comparison indicate that the quality of the West Kentucky No. 11 Seam coal can be improved by cleaning. A 4.29 lb SO_2/MBtu emissions potential and 4.13 lb ash/MBtu ash loading were achieved at a low yield (59 percent)and moderate energy recovery of 84 percent. In another flowsheet test, a 4.03 lb SO_2/MBtu emissions potential and 3.78 lb ash/MBtu ash loading were achieved at a low yield and low energy recovery of 48 and 73 percent, respectively. In both cases the slagging and fouling index classification was not reduced from a medium classification as compared to the raw coal classification. In fact, both the slagging and fouling index slightly increased with cleaning.

- Once incorporated into CQIS and CQIM, this coal characterization of the West Kentucky No. 11 Seam

coal will provide valuable data about the quality of clean coal that can be produced from this raw coal. CQIS and CQIM along with the other models incorporated during the development of the Coal Quality Expert will provide the accurate data needed to predict the impacts of coal quality on power plant performance and cost.

APPENDIX A

Raw Coal Laboratory Analysis

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5- 1-91
MASTER WARNER NO. 097012

C.Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 25557.90 KG

DATE SAMPLED:
DATE RECEIVED: 02/15/91

OTHER ID: SAMPLE NAME RAW COAL AS RECEIVED SAMPLE TOP X 0 FIRST 12 DRUMS TEST DESCRIPTION RAW COAL/LIBERATION -28M MATERIAL WET SCREEN SAMPLE WEIGHT 7 TON (APPROX)

CERTIFICATE OF ANALYSIS

SCREEN SIZE	WT%	MOISTURE	ASH	SULFUR	BTU	LBS SO2 PER MBTU	MAF BTU
+3"SQ	.57	3.38	68.93	3.85	3808	20.20	12257
3"SQ X 1 1/2"SQ	2.04	4.89	39.54	6.22	8170	15.21	13513
1 1/2"SQ X 3/4"SQ	24.78	5.19	31.00	5.75	9615	11.95	13935
3/4"SQ X 3/8"SQ	22.01	2.51	28.58	3.99	10058	7.93	14082
3/8"SQ X 28M	42.58	5.39	39.27	3.17	8394	7.55	13821
28M X 100M	3.63	1.91	23.49	3.90	10687	7.29	13966
100M X 200M	.97	2.01	28.52	4.20	9443	8.89	13210
200M X 0	3.42	2.76	61.95	2.14	4912	8.71	12908

CUMULATIVE RETAINED - DOWN

SCREEN SIZE	WT%	ASH	SULFUR	BTU	LBS SO2 PER MBTU
+3"SQ	.57	68.93	3.85	3808	20.20
+3"SQ X 1 1/2"SQ	2.61	45.93	5.71	7222	15.80
+3"SQ X 3/4"SQ	27.39	32.42	5.74	9387	12.22
+3"SQ X 3/8"SQ	49.40	30.71	4.96	9686	10.23
+3"SQ X 28M	91.98	34.67	4.13	9088	9.08
+3"SQ X 100M	95.61	34.25	4.12	9148	9.00
+3"SQ X 200M	96.58	34.19	4.13	9151	9.02
+3"SQ X 0	100.00	35.14	4.06	9006	9.01

CUMULATIVE RETAINED - UP

SCREEN SIZE	WT%	ASH	SULFUR	BTU	LBS SO2 PER MBTU
+3"SQ X 0	100.00	35.14	4.06	9006	9.01
3"SQ X 0	99.43	34.95	4.06	9036	8.98
1 1/2"SQ X 0	97.39	34.85	4.01	9054	8.85
3/4"SQ X 0	72.61	36.17	3.42	8863	7.71
3/8"SQ X 0	50.60	39.46	3.17	8343	7.59
28M X 0	8.02	40.51	3.19	8072	7.90
100M X 0	4.39	54.55	2.60	5915	8.78
200M X 0	3.42	61.95	2.14	4912	8.71

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

APPROVED BY Thomas A. Light
APPROVED BY [illegible]

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5786

DATE : 5- 1-91
MASTER WARNER NO. 097021

C O , INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 25557.90 KG

DATE SAMPLED:
DATE RECEIVED: 02/15/91

OTHER ID: SAMPLE NAME RAW COAL AS RECEIVED SAMPLE TOP X 0 FIRST 12 DRUMS TEST DESCRIPTION RAW COAL/LIBERATION -28M MATERIAL WET SCREEN SAMPLE WEIGHT 7 TON (APPROX)

FEED FOR SIZE +3" SQ X 3/4" SQ

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		.38	2.20	2.21	14118	0.00	0.00
1.30		25.92	4.46	2.77	13807	0.00	0.00
1.35		27.75	7.84	3.31	13297	0.00	0.00
1.40		3.80	14.11	4.24	12296	0.00	0.00
1.60		6.53	22.50	5.55	10897	0.00	0.00
1.80		2.85	34.04	10.13	8907	0.00	0.00
2.00		2.32	44.58	13.01	7067	0.00	0.00
2.45		4.04	64.85	10.86	4141	0.00	0.00
2.45	SINK	26.40	84.58	10.69	1164	0.00	0.00

CUMULATIVE RESULTS FOR SIZE +3" SQ X 3/4" SQ

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		.38	2.20	2.21	14118	0.00	0.00
1.30		26.30	4.43	2.76	13811	0.00	0.00
1.35		54.06	6.18	3.04	13547	0.00	0.00
1.40		57.86	6.70	3.12	13465	0.00	0.00
1.60		64.39	8.30	3.37	13205	0.00	0.00
1.80		67.24	9.40	3.66	13022	0.00	0.00
2.00		69.56	10.57	3.97	12824	0.00	0.00
2.45		73.60	13.55	4.35	12347	0.00	0.00
2.45	SINK	100.00	32.30	6.02	9395	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	32.30	6.02	9395	0.00	0.00
1.30		99.62	32.42	6.04	9377	0.00	0.00
1.35		73.70	42.25	7.19	7818	0.00	0.00
1.40		45.94	63.04	9.53	4509	0.00	0.00
1.60		42.14	67.45	10.00	3806	0.00	0.00
1.80		35.61	75.69	10.82	2507	0.00	0.00
2.00		32.76	79.32	10.88	1949	0.00	0.00
2.45		30.44	81.97	10.72	1559	0.00	0.00
2.45	SINK	26.40	84.58	10.69	1164	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Lightner
ROEVG

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Galitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5- 1-91
MASTER WARNER NO. 097021

C.Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101, TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 25557.90 KG

DATE SAMPLED:
DATE RECEIVED: 02/15/91

OTHER ID: SAMPLE NAME RAW COAL AS RECEIVED SAMPLE TOP X 0 FIRST 12 DRUMS TEST DESCRIPTION RAW COAL/LIBERATION -28M MATERIAL WET SCREEN SAMPLE WEIGHT 7 TON (APPROX)

FEED FOR SIZE 3/4" SQ X 3/8" SQ

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		19.84	4.02	2.61	13906	0.00	0.00
1.30		21.67	5.86	2.91	13676	0.00	0.00
1.35		23.00	9.13	3.39	13062	0.00	0.00
1.40		3.04	15.59	4.30	11990	0.00	0.00
1.60		4.74	24.84	5.21	10482	0.00	0.00
1.80		1.42	32.49	5.61	9233	0.00	0.00
2.00		1.20	43.67	7.80	7336	0.00	0.00
2.45		2.92	63.73	7.71	4346	0.00	0.00
2.45	SINK	22.16	88.12	5.56	814	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 3/4" SQ X 3/8" SQ

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		19.84	4.02	2.61	13906	0.00	0.00
1.30		41.52	4.98	2.77	13786	0.00	0.00
1.35		64.51	6.46	2.99	13528	0.00	0.00
1.40		67.56	6.87	3.05	13458	0.00	0.00
1.60		72.30	8.05	3.19	13263	0.00	0.00
1.80		73.72	8.52	3.24	13186	0.00	0.00
2.00		74.92	9.08	3.31	13092	0.00	0.00
2.45		77.84	11.13	3.47	12764	0.00	0.00
2.45	SINK	100.00	28.20	3.94	10115	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	28.20	3.94	10115	0.00	0.00
1.30		80.16	34.18	4.27	9177	0.00	0.00
1.35		58.48	44.68	4.77	7510	0.00	0.00
1.40		35.49	67.71	5.66	3912	0.00	0.00
1.60		32.44	72.60	5.79	3155	0.00	0.00
1.80		27.70	80.78	5.89	1900	0.00	0.00
2.00		26.28	83.38	5.90	1505	0.00	0.00
2.45		25.08	85.28	5.81	1225	0.00	0.00
2.45	SINK	22.16	88.12	5.56	814	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Richter
ROCKY

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5- 1-91
MASTER WARNER NO. 097021

C. G., INC
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 25557.90 KG

DATE SAMPLED:
DATE RECEIVED: 02/15/91

OTHER ID: SAMPLE NAME RAW COAL AS RECEIVED SAMPLE TOP X 0 FIRST 12 DRUMS TEST DESCRIPTION RAW COAL/LIBERATION -28M MATERIAL WET SCREEN SAMPLE WEIGHT 7 TON (APPROX)

FEED FOR SIZE 3/8" SQ X 28M

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	2.49	3.80	2.15	13687	0.00	0.00
1.30	22.92	5.34	2.55	13564	0.00	0.00
1.35	15.09	9.48	2.87	12943	0.00	0.00
1.40	8.43	15.06	3.15	12044	0.00	0.00
1.60	9.62	22.75	3.56	10798	0.00	0.00
1.80	3.90	36.36	3.80	8479	0.00	0.00
2.00	2.71	48.19	4.26	6676	0.00	0.00
2.45	8.16	77.35	2.80	2346	0.00	0.00
2.45 SINK	26.69	89.67	3.65	589	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 3/8" SQ X 28M

CUMULATIVE DOWN

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	2.49	3.80	2.15	13687	0.00	0.00
1.30	25.41	5.19	2.52	13576	0.00	0.00
1.35	40.50	6.79	2.65	13340	0.00	0.00
1.40	48.93	8.21	2.73	13117	0.00	0.00
1.60	58.54	10.60	2.87	12736	0.00	0.00
1.80	62.44	12.21	2.93	12471	0.00	0.00
2.00	65.15	13.71	2.98	12229	0.00	0.00
2.45	73.31	20.79	2.96	11129	0.00	0.00
2.45 SINK	100.00	39.18	3.15	8316	0.00	0.00

CUMULATIVE UP

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	100.00	39.18	3.15	8316	0.00	0.00
1.30	97.51	40.08	3.17	8179	0.00	0.00
1.35	74.59	50.75	3.36	6524	0.00	0.00
1.40	59.50	61.22	3.49	4897	0.00	0.00
1.60	51.07	68.84	3.54	3717	0.00	0.00
1.80	41.46	79.52	3.54	2074	0.00	0.00
2.00	37.56	84.00	3.51	1410	0.00	0.00
2.45	34.85	86.79	3.45	1000	0.00	0.00
2.45 SINK	26.69	89.67	3.65	589	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS.

Thomas A. [signature]

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
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St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5- 1-91
MASTER WARNER NO. 097021

C.Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 25557.90 KG

DATE SAMPLED:
DATE RECEIVED: 02/15/91

OTHER ID: SAMPLE NAME RAW COAL AS RECEIVED SAMPLE TOP X 0 FIRST 12 DRUMS TEST DESCRIPTION RAW COAL/LIBERATION -28M MATERIAL WET SCREEN SAMPLE WEIGHT 7 TON (APPROX)

FEED FOR SIZE 28M X 100M

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		14.31	1.92	1.99	13979	0.00	0.00
1.30		28.00	2.84	2.36	13814	0.00	0.00
1.35		9.92	4.56	2.58	13521	0.00	0.00
1.40		10.42	5.81	2.74	13464	0.00	0.00
1.60		12.34	14.84	3.53	12157	0.00	0.00
1.80		1.94	32.87	4.61	9296	0.00	0.00
2.00		.93	43.53	5.17	7243	0.00	0.00
2.45		1.77	61.21	6.78	4348	0.00	0.00
2.45	SINK	20.37	81.51	7.55	526	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 28M X 100M

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		14.31	1.92	1.99	13979	0.00	0.00
1.30		42.31	2.53	2.23	13870	0.00	0.00
1.35		52.23	2.91	2.30	13804	0.00	0.00
1.40		62.65	3.40	2.37	13747	0.00	0.00
1.60		74.99	5.28	2.56	13486	0.00	0.00
1.80		76.93	5.98	2.61	13380	0.00	0.00
2.00		77.86	6.42	2.65	13307	0.00	0.00
2.45		79.63	7.64	2.74	13108	0.00	0.00
2.45	SINK	100.00	22.69	3.72	10544	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	22.69	3.72	10544	0.00	0.00
1.30		85.69	26.16	4.01	9971	0.00	0.00
1.35		57.69	37.48	4.80	8105	0.00	0.00
1.40		47.77	44.31	5.27	6981	0.00	0.00
1.60		37.35	55.05	5.97	5172	0.00	0.00
1.80		25.01	74.89	7.18	1726	0.00	0.00
2.00		23.07	78.42	7.39	1089	0.00	0.00
2.45		22.14	79.89	7.48	831	0.00	0.00
2.45	SINK	20.37	81.51	7.55	526	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Rybolt
Randy

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
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Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5- 1-91
MASTER WARNER NO. 104909

C Q , INC
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO. : PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1652.0 KG

DATE SAMPLED:
DATE RECEIVED: 041891

OTHER ID: SAMPLE NAME RAW COAL, AS RECEIVED SAMPLE TOP X 0 100M X 200M

	% WT.	% MOIST.	% ASH	%SULFUR	BTU	% VOL.	% FIX. CAR.
RAW	100.00	3.52	26.87	3.77	9632	0.00	0.00
			27.85	3.91	9983	0.00	0.00
					13837 (MAF)		

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	16.53	1.38	2.01	14145	0.00	0.00
1.30	15.95	2.30	2.29	14058	0.00	0.00
1.35	12.08	3.47	2.49	13932	0.00	0.00
1.40	7.57	4.56	2.46	13837	0.00	0.00
1.60	13.20	9.41	2.75	13174	0.00	0.00
1.80	4.36	17.33	3.27	11960	0.00	0.00
2.00	1.62	33.58	4.65	8280	0.00	0.00
2.45	2.08	63.41	7.25	4390	0.00	0.00
2.45 SINK	26.60	85.06	7.49	700	0.00	0.00

Thomas A. Lytton

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5786

DATE : 5- 1-91
MASTER WARNER NO. 104909

C. Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO. PROJECT 90D0101 TASK 2.2
MINE:
DATE SAMPLED:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1652.0 KG
DATE RECEIVED: 041891

OTHER ID: SAMPLE NAME RAW COAL, AS RECEIVED SAMPLE TOP X 0 100M X 200M

CUMULATIVE RESULTS FOR RAW

CUMULATIVE DOWN

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	16.53	1.38	2.01	14145	0.00	0.00
1.30	32.47	1.83	2.15	14102	0.00	0.00
1.35	44.56	2.28	2.24	14056	0.00	0.00
1.40	52.12	2.61	2.27	14024	0.00	0.00
1.60	65.33	3.98	2.37	13852	0.00	0.00
1.80	69.69	4.82	2.43	13734	0.00	0.00
2.00	71.31	5.47	2.48	13610	0.00	0.00
2.45	73.40	7.12	2.61	13348	0.00	0.00
2.45 SINK	100.00	27.85	3.91	9983	0.00	0.00

CUMULATIVE UP

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	100.00	27.85	3.91	9983	0.00	0.00
1.30	83.47	33.09	4.28	9159	0.00	0.00
1.35	67.53	40.37	4.76	8003	0.00	0.00
1.40	55.44	48.41	5.25	6710	0.00	0.00
1.60	47.88	55.34	5.69	5584	0.00	0.00
1.80	34.67	72.83	6.81	2693	0.00	0.00
2.00	30.31	80.82	7.32	1359	0.00	0.00
2.45	28.69	83.49	7.47	968	0.00	0.00
2.45 SINK	26.60	85.06	7.49	700	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Rylton
[signature]

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5- 1-91
MASTER WARNER NO. 105625

C. Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
DATE SAMPLED:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 16.520 KG
DATE RECEIVED: 042491

OTHER ID: SAMPLE NAME RAW COAL, AS-RECEIVED SAMPLE TOP X 0 200M X 0

	% WT.	% MOIST.	% ASH	%SULFUR	BTU	% VOL.	% FIX. CAR.
RAW	100.00	3.55	58.25	2.19	5012	0.00	0.00
			60.39	2.27	5196	0.00	0.00
					13120 (MAF)		

GRAVITY	% WT	%ASH	% S	BTU
1.30	.08	1.80	1.86	13940.
1.35	.12	3.13	2.04	13732.
1.40	1.13	5.68	2.09	13508.
1.60	7.47	9.19	1.80	13092.
1.80	4.11	15.66	1.57	12237.
2.00	11.54	35.55	1.68	9044.
2.45	45.99	63.31	1.75	4764.
2.45 SINK	29.57	87.18	3.54	1019.

	CUMULATIVE DOWN			RAW	CUMULATIVE UP			
GRAVITY	% WT	% ASH	% S	BTU	% WT	% ASH	% S	BTU
1.30	.08	1.80	1.86	13940.	100.0	60.39	2.27	5196.
1.35	.20	2.62	1.97	13813.	99.92	60.44	2.27	5190.
1.40	1.33	5.23	2.08	13553.	99.80	60.51	2.27	5179.
1.60	8.80	8.59	1.84	13162.	98.67	61.14	2.27	5084.
1.80	12.90	10.84	1.76	12868.	91.20	65.39	2.31	4428.
2.00	24.44	22.51	1.72	11063.	87.10	67.74	2.35	4060.
2.45	70.43	49.15	1.74	6950.	75.56	72.65	2.45	3299.
2.45 SINK	100.0	60.39	2.27	5196.	29.57	87.18	3.54	1019.

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

NOTE: 0.1 GRAM OUT OF 4973.2 GRAMS FLOATED AT 1.25

GOULD energy

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Warner Laboratories Division Galitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
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Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

C.Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

DATE: 04/30/91
MASTER WARNER NO. 097021

SAMPLE ID: RUN #90113011 SAMPLER #41001 KENTUCKY #11

OPERATING CO: PROJECT 90D0101 TASK 2.2
SAMPLED BY: CUSTOMER PROVIDED
DATE SAMPLED:

GROSS WEIGHT: 7 TON (APPROX)
DATE RECEIVED: 02/15/91

OTHER ID: SAMPLE NAME RAW COAL AS RECEIVED SAMPLE TOP X 0 FIRST 12 DRUMS
TEST DESCRIPTION RAW COAL/LIBERATION -28 MESH MATERIAL WET SCREEN

FEED FOR SIZE +3" SQ X 0

GRAVITY	WT%	% ASH	% SULFUR	BTU
1.25	6.21	3.71	2.46	13884
1.30	22.80	5.04	2.68	13678
1.35	19.57	8.62	3.17	13128
1.40	5.79	14.15	3.44	12208
1.60	7.76	21.85	4.17	10972
1.80	3.01	34.04	5.54	8912
2.00	2.50	44.64	6.47	7237
2.45	6.88	70.67	4.36	3399
2.45 SINK	25.48	87.55	6.16	812

CUMULATIVE DOWN

GRAVITY	WT%	ASH	SULFUR	BTU
1.25	6.21	3.71	2.46	13884
1.30	29.01	4.76	2.63	13722
1.35	48.58	6.31	2.85	13483
1.40	54.37	7.15	2.91	13347
1.60	62.13	8.98	3.07	13050
1.80	65.14	10.14	3.18	12859
2.00	67.64	11.42	3.30	12651
2.45	74.52	16.89	3.40	11797
2.45 SINK	100.00	34.89	4.10	8998

CUMULATIVE UP

GRAVITY	WT%	ASH	SULFUR	BTU
1.25	100.00	34.89	4.10	8998
1.30	93.79	36.96	4.21	8675
1.35	70.99	47.21	4.71	7068
1.40	51.42	61.89	5.29	4761
1.60	45.63	67.95	5.53	3816
1.80	37.87	77.40	5.80	2350
2.00	34.86	81.14	5.83	1783
2.45	32.36	83.96	5.78	1362
2.45 SINK	25.48	87.55	6.16	812

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Right
Paul E Kelly

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
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St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5-31-91
MASTER WARNER NO. 107258

C. Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1585.30 KG

DATE SAMPLED:
DATE RECEIVED: 050891

OTHER ID: RAW COAL / LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 1 1/2" X 0 LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 1 1/2" X 0

CERTIFICATE OF ANALYSIS

SCREEN SIZE	WT%	MOISTURE	ASH	SULFUR	BTU	LBS SO2 PER MBTU	MAF BTU
+1 1/2" SQ	.71	3.03	61.49	6.62	4426	29.88	11492
1 1/2" SQ X 3/4" SQ	20.46	5.14	29.07	5.86	9779	11.97	13786
3/4" SQ X 3/8" SQ	19.48	2.57	28.70	4.24	9925	8.54	13920
3/8" SQ X 28M	50.63	2.70	38.38	3.38	8527	7.92	13837
28M X 100M	3.94	.94	24.29	3.98	10472	7.59	13832
100M X 200M	.91	3.01	32.43	4.19	9037	9.26	13373
200M X 0	3.87	1.98	61.91	2.16	4915	8.78	12904

CUMULATIVE RETAINED - DOWN

SCREEN SIZE	WT%	ASH	SULFUR	BTU	LBS SO2 PER MBTU
+1 1/2" SQ	.71	61.49	6.62	4426	29.88
+1 1/2" SQ X 3/4" SQ	21.17	30.16	5.89	9599	12.26
+1 1/2" SQ X 3/8" SQ	40.65	29.46	5.10	9755	10.45
+1 1/2" SQ X 28M	91.28	34.41	4.15	9074	9.14
+1 1/2" SQ X 100M	95.22	33.99	4.14	9132	9.06
+1 1/2" SQ X 200M	96.13	33.97	4.14	9131	9.06
+1 1/2" SQ X 0	100.00	35.06	4.06	8967	9.05

CUMULATIVE RETAINED - UP

SCREEN SIZE	WT%	ASH	SULFUR	BTU	LBS SO2 PER MBTU
+1 1/2" SQ X 0	100.00	35.06	4.06	8967	9.05
1 1/2" SQ X 0	99.29	34.87	4.04	9000	8.97
3/4" SQ X 0	78.83	36.37	3.57	8798	8.11
3/8" SQ X 0	59.35	38.89	3.35	8428	7.94
28M X 0	8.72	41.85	3.19	7854	8.12
100M X 0	4.78	56.31	2.55	5699	8.94
200M X 0	3.87	61.91	2.16	4915	8.78

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

PAGE 1

APPROVED BY Thomas A. Rupert
APPROVED BY Albert Sheehan

GOULD energy

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St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5-29-91
MASTER WARNER NO. 107266

C.Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1585.30 KG

DATE SAMPLED:
DATE RECEIVED: 050891

OTHER ID: RAW COAL / LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 1 1/2" X 0 LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 1 1/2" X 0

FEED FOR SIZE +1 1/2"SQ X 3/4"SQ

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		6.11	3.39	2.60	13951	0.00	0.00
1.30		30.68	5.21	2.86	13676	0.00	0.00
1.35		21.48	8.64	3.42	13141	0.00	0.00
1.40		3.88	14.87	4.60	12134	0.00	0.00
1.60		5.68	22.22	5.77	10991	0.00	0.00
1.80		2.23	33.75	7.16	8962	0.00	0.00
2.00		1.43	44.96	13.25	7100	0.00	0.00
2.45		5.76	70.47	9.42	3246	0.00	0.00
2.45	SINK	22.75	83.99	12.22	1373	0.00	0.00

CUMULATIVE RESULTS FOR SIZE +1 1/2"SQ X 3/4"SQ

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		6.11	3.39	2.60	13951	0.00	0.00
1.30		36.79	4.91	2.82	13722	0.00	0.00
1.35		58.27	6.28	3.04	13508	0.00	0.00
1.40		62.15	6.82	3.14	13422	0.00	0.00
1.60		67.83	8.11	3.36	13218	0.00	0.00
1.80		70.06	8.92	3.48	13083	0.00	0.00
2.00		71.49	9.65	3.67	12963	0.00	0.00
2.45		77.25	14.18	4.10	12238	0.00	0.00
2.45	SINK	100.00	30.06	5.95	9767	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	30.06	5.95	9767	0.00	0.00
1.30		93.89	31.80	6.17	9494	0.00	0.00
1.35		63.21	44.71	7.77	7464	0.00	0.00
1.40		41.73	63.27	10.01	4543	0.00	0.00
1.60		37.85	68.23	10.57	3765	0.00	0.00
1.80		32.17	76.35	11.41	2489	0.00	0.00
2.00		29.94	79.52	11.73	2008	0.00	0.00
2.45		28.51	81.26	11.65	1752	0.00	0.00
2.45	SINK	22.75	83.99	12.22	1373	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Richter
Robert Shuman

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
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St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5-29-91
MASTER WARNER NO. 107266

C. Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
DATE SAMPLED:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1585.30 KG
DATE RECEIVED: 050891

OTHER ID: RAW COAL / LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 1 1/2" X 0 LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 1 1/2" X 0

FEED FOR SIZE 3/4"SQ X 3/8"SQ

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	14.78	3.96	2.64	13830	0.00	0.00
1.30	27.87	5.88	2.90	13588	0.00	0.00
1.35	21.92	9.04	3.44	12910	0.00	0.00
1.40	3.75	16.82	4.54	11785	0.00	0.00
1.60	3.80	26.86	5.29	10182	0.00	0.00
1.80	1.98	35.22	6.82	8744	0.00	0.00
2.00	.89	46.69	9.17	6815	0.00	0.00
2.45	6.36	80.68	4.37	1970	0.00	0.00
2.45 SINK	18.65	87.93	7.40	886	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 3/4"SQ X 3/8"SQ

CUMULATIVE DOWN

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	14.78	3.96	2.64	13830	0.00	0.00
1.30	42.65	5.22	2.81	13672	0.00	0.00
1.35	64.57	6.52	3.02	13413	0.00	0.00
1.40	68.32	7.08	3.11	13324	0.00	0.00
1.60	72.12	8.12	3.22	13158	0.00	0.00
1.80	74.10	8.85	3.32	13040	0.00	0.00
2.00	74.99	9.30	3.39	12966	0.00	0.00
2.45	81.35	14.88	3.46	12106	0.00	0.00
2.45 SINK	100.00	28.50	4.20	10014	0.00	0.00

CUMULATIVE UP

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	100.00	28.50	4.20	10014	0.00	0.00
1.30	85.22	32.76	4.47	9352	0.00	0.00
1.35	57.35	45.82	5.23	7294	0.00	0.00
1.40	35.43	68.57	6.34	3819	0.00	0.00
1.60	31.68	74.69	6.55	2877	0.00	0.00
1.80	27.88	81.20	6.73	1882	0.00	0.00
2.00	25.90	84.73	6.72	1356	0.00	0.00
2.45	25.01	86.09	6.63	1161	0.00	0.00
2.45 SINK	18.65	87.93	7.40	886	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. ...
Albert Shak...

AMERICAN COUNCIL OF INDEPENDENT LABORATORIES, INC.

A2LA

GOULD energy

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Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
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Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5-29-91
MASTER WARNER NO. 107266

C. Q. , INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1585.30 KG

DATE SAMPLED:
DATE RECEIVED: 050891

OTHER ID: RAW COAL / LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 1 1/2" X 0 LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 1 1/2" X 0

FEED FOR SIZE 3/8"SQ X 28M

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	6.58	3.59	2.37	13946	0.00	0.00
1.30	20.64	6.03	2.72	13517	0.00	0.00
1.35	12.04	8.80	2.94	13055	0.00	0.00
1.40	7.49	12.17	3.23	12371	0.00	0.00
1.60	13.09	22.05	3.55	10810	0.00	0.00
1.80	5.32	36.09	3.86	8605	0.00	0.00
2.00	1.68	51.44	4.92	6436	0.00	0.00
2.45	3.85	73.59	4.63	2917	0.00	0.00
2.45 SINK	29.32	90.92	3.49	549	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 3/8"SQ X 28M

CUMULATIVE DOWN

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	6.58	3.59	2.37	13946	0.00	0.00
1.30	27.22	5.44	2.63	13621	0.00	0.00
1.35	39.26	6.47	2.73	13447	0.00	0.00
1.40	46.75	7.38	2.81	13275	0.00	0.00
1.60	59.83	10.59	2.97	12736	0.00	0.00
1.80	65.15	12.67	3.04	12399	0.00	0.00
2.00	66.83	13.64	3.09	12249	0.00	0.00
2.45	70.68	16.91	3.17	11741	0.00	0.00
2.45 SINK	100.00	38.61	3.27	8459	0.00	0.00

CUMULATIVE UP

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	100.00	38.61	3.27	8459	0.00	0.00
1.30	93.42	41.08	3.33	8073	0.00	0.00
1.35	72.78	51.02	3.51	6528	0.00	0.00
1.40	60.74	59.38	3.62	5235	0.00	0.00
1.60	53.25	66.02	3.67	4232	0.00	0.00
1.80	40.17	80.35	3.71	2089	0.00	0.00
2.00	34.85	87.10	3.69	1094	0.00	0.00
2.45	33.17	88.91	3.63	824	0.00	0.00
2.45 SINK	29.32	90.92	3.49	549	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Right
Robert Shuhan

GOULD energy

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Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
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St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5-29-91
MASTER WARNER NO. 107266

C.Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1585.30 KG

DATE SAMPLED:
DATE RECEIVED: 050891

OTHER ID: RAW COAL / LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 1 1/2" X 0 LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 1 1/2" X 0

FEED FOR SIZE 28M X 100M

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		5.88	1.12	1.92	13975	0.00	0.00
1.30		16.78	2.09	2.32	13917	0.00	0.00
1.35		25.36	3.33	2.60	13789	0.00	0.00
1.40		9.94	5.58	2.91	13441	0.00	0.00
1.60		14.50	10.82	3.33	12740	0.00	0.00
1.80		2.45	25.37	4.05	10443	0.00	0.00
2.00		1.47	41.31	6.20	7424	0.00	0.00
2.45		2.11	67.38	7.27	3470	0.00	0.00
2.45	SINK	21.51	82.87	7.43	632	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 28M X 100M

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		5.88	1.12	1.92	13975	0.00	0.00
1.30		22.66	1.84	2.21	13932	0.00	0.00
1.35		48.02	2.62	2.41	13856	0.00	0.00
1.40		57.96	3.13	2.50	13785	0.00	0.00
1.60		72.46	4.67	2.66	13576	0.00	0.00
1.80		74.91	5.35	2.71	13473	0.00	0.00
2.00		76.38	6.04	2.78	13357	0.00	0.00
2.45		78.49	7.69	2.90	13091	0.00	0.00
2.45	SINK	100.00	23.86	3.87	10411	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	23.86	3.87	10411	0.00	0.00
1.30		94.12	25.28	3.99	10189	0.00	0.00
1.35		77.34	30.31	4.36	9380	0.00	0.00
1.40		51.98	43.48	5.22	7229	0.00	0.00
1.60		42.04	52.44	5.77	5760	0.00	0.00
1.80		27.54	74.35	7.05	2085	0.00	0.00
2.00		25.09	79.14	7.34	1268	0.00	0.00
2.45		23.62	81.49	7.41	886	0.00	0.00
2.45	SINK	21.51	82.87	7.43	632	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Richter
Robert Sheldon

GOULD energy

Gould Energy 30 Claimont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Claimont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5-29-91
MASTER WARNER NO. 107266

C.G., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1585.30 KG

DATE SAMPLED:
DATE RECEIVED: 050891

OTHER ID: RAW COAL / LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 1 1/2" X 0 LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 1 1/2" X 0

FEED FOR SIZE 100M X 200M

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		12.91	1.47	2.09	14122	0.00	0.00
1.30		9.17	1.99	2.22	13929	0.00	0.00
1.35		8.85	2.62	2.45	13941	0.00	0.00
1.40		8.31	2.99	2.43	13903	0.00	0.00
1.60		23.20	7.14	2.70	13491	0.00	0.00
1.80		3.42	21.76	3.87	11104	0.00	0.00
2.00		1.26	39.26	5.48	8046	0.00	0.00
2.45		3.13	75.23	9.66	2509	0.00	0.00
2.45	SINK	29.75	86.35	7.26	677	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 100M X 200M

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		12.91	1.47	2.09	14122	0.00	0.00
1.30		22.09	1.69	2.15	14042	0.00	0.00
1.35		30.94	1.95	2.23	14013	0.00	0.00
1.40		39.24	2.17	2.27	13990	0.00	0.00
1.60		62.45	4.02	2.43	13805	0.00	0.00
1.80		65.86	4.94	2.51	13665	0.00	0.00
2.00		67.12	5.58	2.56	13559	0.00	0.00
2.45		70.25	8.69	2.88	13067	0.00	0.00
2.45	SINK	100.00	31.79	4.18	9381	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	31.79	4.18	9381	0.00	0.00
1.30		87.09	36.29	4.49	8678	0.00	0.00
1.35		77.91	40.32	4.76	8060	0.00	0.00
1.40		69.06	45.15	5.06	7307	0.00	0.00
1.60		60.76	50.92	5.41	6404	0.00	0.00
1.80		37.55	77.97	7.09	2026	0.00	0.00
2.00		34.14	83.59	7.42	1117	0.00	0.00
2.45		32.88	85.29	7.49	852	0.00	0.00
2.45	SINK	29.75	86.35	7.26	677	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Richter
Robert Sheehan

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5-29-91
MASTER WARNER NO. 107266

C. G., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1585.30 KG

DATE SAMPLED:
DATE RECEIVED: 050891

OTHER ID: RAW COAL / LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 1 1/2" X 0 LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 1 1/2" X 0

FEED FOR SIZE 200M X 0

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		.02	2.04	1.72	13959	0.00	0.00
1.30		.03	2.14	1.72	13808	0.00	0.00
1.35		.17	2.28	1.80	13791	0.00	0.00
1.40		.50	2.95	1.84	13717	0.00	0.00
1.60		19.93	10.18	1.66	12783	0.00	0.00
1.80		7.87	17.89	1.27	11858	0.00	0.00
2.00		5.63	30.64	1.36	9648	0.00	0.00
2.45		17.54	68.60	1.29	4052	0.00	0.00
2.45	SINK	48.32	89.63	4.03	796	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 200M X 0

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		.02	2.04	1.72	13959	0.00	0.00
1.30		.05	2.10	1.72	13869	0.00	0.00
1.35		.22	2.24	1.78	13809	0.00	0.00
1.40		.72	2.73	1.82	13745	0.00	0.00
1.60		20.65	9.92	1.67	12817	0.00	0.00
1.80		28.52	12.12	1.56	12552	0.00	0.00
2.00		34.15	15.17	1.52	12073	0.00	0.00
2.45		51.68	33.30	1.44	9351	0.00	0.00
2.45	SINK	100.00	60.52	2.69	5218	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	60.52	2.69	5218	0.00	0.00
1.30		99.98	60.53	2.69	5216	0.00	0.00
1.35		99.95	60.55	2.69	5214	0.00	0.00
1.40		99.78	60.65	2.69	5199	0.00	0.00
1.60		99.28	60.94	2.70	5156	0.00	0.00
1.80		79.35	73.68	2.96	3240	0.00	0.00
2.00		71.48	79.83	3.14	2292	0.00	0.00
2.45		65.85	84.03	3.30	1663	0.00	0.00
2.45	SINK	48.32	89.63	4.03	796	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Richter
Robert Sheehan

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
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St. Louis Energy Division 11591 Page Service Drive, St Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5-29-91
MASTER WARNER NO. 107266

C. Q. , INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO. : PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1585.30 KG

DATE SAMPLED:
DATE RECEIVED: 050891

OTHER ID: RAW COAL / LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 1 1/2" X 0 LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 1 1/2" X 0

FEED FOR COMPOSITE +1 1/2" SQ X 0

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		7.85	3.59	2.49	13908	0.00	0.00
1.30		23.12	5.64	2.79	13591	0.00	0.00
1.35		16.00	8.44	3.19	13091	0.00	0.00
1.40		5.83	12.54	3.55	12361	0.00	0.00
1.60		10.12	20.57	3.77	11101	0.00	0.00
1.80		3.98	33.96	4.35	8973	0.00	0.00
2.00		1.61	46.45	6.51	7082	0.00	0.00
2.45		5.20	73.81	5.32	2923	0.00	0.00
2.45	SINK	26.28	88.84	5.84	768	0.00	0.00

CUMULATIVE RESULTS FOR COMPOSITE +1 1/2" SQ X 0

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		7.85	3.59	2.49	13908	0.00	0.00
1.30		30.98	5.12	2.71	13671	0.00	0.00
1.35		46.97	6.25	2.87	13474	0.00	0.00
1.40		52.80	6.94	2.95	13351	0.00	0.00
1.60		62.92	9.14	3.08	12989	0.00	0.00
1.80		66.91	10.61	3.15	12750	0.00	0.00
2.00		68.52	11.46	3.23	12616	0.00	0.00
2.45		73.72	15.86	3.38	11933	0.00	0.00
2.45	SINK	100.00	35.04	4.03	8999	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	35.04	4.03	8999	0.00	0.00
1.30		92.15	37.72	4.16	8580	0.00	0.00
1.35		69.02	48.46	4.62	6902	0.00	0.00
1.40		53.03	60.54	5.05	5034	0.00	0.00
1.60		47.20	66.46	5.23	4130	0.00	0.00
1.80		37.08	78.99	5.63	2227	0.00	0.00
2.00		33.09	84.41	5.79	1415	0.00	0.00
2.45		31.48	86.36	5.75	1124	0.00	0.00
2.45	SINK	26.28	88.84	5.84	768	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Richter
Robert Sheehan

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
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St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 4-30-91
~~MASTER WARNER NO. 098415~~

C.Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY NO. 11 RUN #90113001 #41001

OPERATING CO.: RAW COAL/LIBERATION
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 635.30 KG

DATE SAMPLED:
DATE RECEIVED: 2/28/91

OTHER ID: RAW COAL SPLIT CRUSHED TO 3/4-IN X 0 LABORATORY SPLIT OF AS-RECEIVED SAMPLE CRUSHED TO 3/4-IN X 0 -28M MATERIAL WET SCREENED

CERTIFICATE OF ANALYSIS

SCREEN SIZE	WT%	MOISTURE	ASH	SULFUR	BTU	LBS SO2 PER MBTU	MAF BTU
+3/4" SQ	1.72	2.68	49.81	8.00	6808	23.48	13564
3/4" SQ X 3/8" SQ	30.83	4.75	31.71	5.33	9581	11.12	14030
3/8" SQ X 28M	58.94	4.23	36.50	3.48	8725	7.97	13739
28M X 100M	4.03	2.05	23.29	3.85	10514	7.32	13706
100M X 200M	.93	2.58	31.23	4.47	9476	9.43	13778
200M X 0	3.55	1.51	62.60	2.12	4921	8.61	13158

CUMULATIVE RETAINED - DOWN

SCREEN SIZE	WT%	ASH	SULFUR	BTU	LBS SO2 PER MBTU
+3/4" SQ	1.72	49.81	8.00	6808	23.48
+3/4" SQ X 3/8" SQ	32.55	32.67	5.47	9435	11.58
+3/4" SQ X 28M	91.49	35.14	4.19	8977	9.33
+3/4" SQ X 100M	95.52	34.64	4.17	9042	9.21
+3/4" SQ X 200M	96.45	34.60	4.18	9046	9.23
+3/4" SQ X 0	100.00	35.60	4.10	8900	9.20

CUMULATIVE RETAINED - UP

SCREEN SIZE	WT%	ASH	SULFUR	BTU	LBS SO2 PER MBTU
+3/4" SQ X 0	100.00	35.60	4.10	8900	9.20
3/4" SQ X 0	98.28	35.35	4.04	8937	9.03
3/8" SQ X 0	67.45	37.01	3.44	8642	7.95
28M X 0	8.51	40.55	3.20	8068	7.93
100M X 0	4.48	56.08	2.61	5868	8.89
200M X 0	3.55	62.60	2.12	4921	8.61

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

PAGE 1

APPROVED BY Thomas A. Righter
APPROVED BY

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/

DATE : 5-28-91
MASTER WARNER NO. 098422

C. Q., INC.
~~1 QUALITY CENTER BOX 280~~
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY NO. 11 RUN #90113001 #41001

OPERATING CO. RAW COAL/LIBERATION
MINE:
DATE SAMPLED:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 635.30 KG
DATE RECEIVED: 2/28/91

OTHER ID: RAW COAL SPLIT CRUSHED TO 3/4-IN X 0 LABORATORY SPLIT OF AS-RECEIVED SAMPLE CRUSHED TO 3/4-IN X 0 -28M MATERIAL WET SCREENED

FEED FOR SIZE +3/4"SQ X 3/8"SQ

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	7.93	3.46	2.48	13987	0.00	0.00
1.30	34.50	5.09	2.74	13747	0.00	0.00
1.35	16.94	9.37	3.37	12973	0.00	0.00
1.40	2.88	15.70	4.14	12048	0.00	0.00
1.60	4.64	25.64	4.76	10485	0.00	0.00
1.80	1.49	36.49	6.76	8743	0.00	0.00
2.00	.98	48.38	8.68	6752	0.00	0.00
2.45	3.26	71.46	7.85	3284	0.00	0.00
2.45 SINK	27.39	85.79	9.86	1097	0.00	0.00

CUMULATIVE RESULTS FOR SIZE +3/4"SQ X 3/8"SQ

CUMULATIVE DOWN

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	7.93	3.46	2.48	13987	0.00	0.00
1.30	42.42	4.79	2.69	13792	0.00	0.00
1.35	59.36	6.10	2.89	13558	0.00	0.00
1.40	62.24	6.54	2.95	13488	0.00	0.00
1.60	66.88	7.87	3.07	13280	0.00	0.00
1.80	68.37	8.49	3.15	13181	0.00	0.00
2.00	69.35	9.05	3.23	13090	0.00	0.00
2.45	72.61	11.86	3.44	12650	0.00	0.00
2.45 SINK	100.00	32.11	5.20	9485	0.00	0.00

CUMULATIVE UP

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	100.00	32.11	5.20	9485	0.00	0.00
1.30	92.07	34.57	5.43	9098	0.00	0.00
1.35	57.58	52.23	7.04	6313	0.00	0.00
1.40	40.64	70.10	8.57	3536	0.00	0.00
1.60	37.76	74.25	8.91	2888	0.00	0.00
1.80	33.12	81.05	9.49	1824	0.00	0.00
2.00	31.63	83.15	9.62	1498	0.00	0.00
2.45	30.65	84.27	9.65	1330	0.00	0.00
2.45 SINK	27.39	85.79	9.86	1097	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Ryhter

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813

DATE : 5-28-91
MASTER WARNER NO. 098422

C. Q., INC.
~~1 QUALITY CENTER BOX 280~~
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY NO. 11 RUN #90113001 #41001

OPERATING CO.: RAW COAL/LIBERATION
MINE:
DATE SAMPLED:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 635.30 KG
DATE RECEIVED: 2/28/91

OTHER ID: RAW COAL SPLIT CRUSHED TO 3/4-IN X 0 LABORATORY SPLIT OF AS-RECEIVED SAMPLE CRUSHED TO 3/4-IN X 0 -28M MATERIAL WET SCREENED

FEED FOR SIZE 3/8"SQ X 28M

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	7.23	3.07	2.19	14019	0.00	0.00
1.30	26.28	5.64	2.66	13611	0.00	0.00
1.35	15.90	10.49	3.11	12961	0.00	0.00
1.40	4.59	14.89	3.45	12225	0.00	0.00
1.60	9.22	24.93	3.62	10725	0.00	0.00
1.80	3.08	38.16	4.00	8414	0.00	0.00
2.00	1.16	46.33	5.08	7037	0.00	0.00
2.45	3.55	72.61	5.09	2951	0.00	0.00
2.45 SINK	29.00	89.59	4.66	594	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 3/8"SQ X 28M

CUMULATIVE DOWN

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	7.23	3.07	2.19	14019	0.00	0.00
1.30	33.51	5.08	2.56	13699	0.00	0.00
1.35	49.41	6.82	2.73	13462	0.00	0.00
1.40	53.99	7.51	2.80	13357	0.00	0.00
1.60	63.22	10.05	2.92	12973	0.00	0.00
1.80	66.30	11.35	2.97	12761	0.00	0.00
2.00	67.45	11.95	3.00	12663	0.00	0.00
2.45	71.00	14.98	3.11	12178	0.00	0.00
2.45 SINK	100.00	36.62	3.56	8819	0.00	0.00

CUMULATIVE UP

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	100.00	36.62	3.56	8819	0.00	0.00
1.30	92.77	39.24	3.66	8413	0.00	0.00
1.35	66.49	52.52	4.06	6359	0.00	0.00
1.40	50.59	65.72	4.36	4284	0.00	0.00
1.60	46.01	70.79	4.45	3492	0.00	0.00
1.80	36.78	82.29	4.66	1679	0.00	0.00
2.00	33.70	86.32	4.72	1064	0.00	0.00
2.45	32.55	87.74	4.71	851	0.00	0.00
2.45 SINK	29.00	89.59	4.66	594	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Ryhter
RDCKG

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/[illegible]

DATE : 5-28-91
MASTER WARNER NO. 098422

C. Q. , INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY NO. 11 RUN #90113001 #41001

OPERATING CO.: RAW COAL/LIBERATION
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 635.30 KG

DATE SAMPLED:
DATE RECEIVED: 2/28/91

OTHER ID: RAW COAL SPLIT CRUSHED TO 3/4-IN X 0 LABORATORY SPLIT OF AS-RECEIVED SAMPLE CRUSHED TO 3/4-IN X 0 -28M MATERIAL WET SCREENED

FEED FOR SIZE 28M X 100M

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		20.59	1.51	1.95	13997	0.00	0.00
1.30		28.64	3.48	2.47	13726	0.00	0.00
1.35		3.03	5.24	2.77	13331	0.00	0.00
1.40		11.00	7.20	2.87	13015	0.00	0.00
1.60		11.24	15.69	3.33	11892	0.00	0.00
1.80		1.52	31.54	4.66	9395	0.00	0.00
2.00		1.07	44.21	5.74	7161	0.00	0.00
2.45		1.72	60.59	7.68	4394	0.00	0.00
2.45	SINK	21.20	82.13	8.28	668	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 28M X 100M

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		20.59	1.51	1.95	13997	0.00	0.00
1.30		49.23	2.66	2.26	13839	0.00	0.00
1.35		52.26	2.81	2.28	13809	0.00	0.00
1.40		63.25	3.57	2.39	13671	0.00	0.00
1.60		74.49	5.40	2.53	13403	0.00	0.00
1.80		76.01	5.92	2.57	13323	0.00	0.00
2.00		77.08	6.45	2.62	13237	0.00	0.00
2.45		78.80	7.63	2.73	13044	0.00	0.00
2.45	SINK	100.00	23.43	3.90	10420	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	23.43	3.90	10420	0.00	0.00
1.30		79.41	29.11	4.41	9493	0.00	0.00
1.35		50.77	43.57	5.50	7105	0.00	0.00
1.40		47.74	46.00	5.67	6711	0.00	0.00
1.60		36.75	57.61	6.51	4824	0.00	0.00
1.80		25.51	76.08	7.92	1710	0.00	0.00
2.00		23.99	78.89	8.12	1225	0.00	0.00
2.45		22.92	80.52	8.23	947	0.00	0.00
2.45	SINK	21.20	82.13	8.28	668	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Lytle

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 244, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/685-[illegible]

DATE : 5-28-91
MASTER WARNER NO. 106185

C. G., INC.
~~1 QUALITY CENTER BOX 280~~
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90A0103
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 635.3 KG

DATE SAMPLED:
DATE RECEIVED: 042991

OTHER ID: RAW COAL SPLIT CRUSHED TO 3/4" X 0 LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 3/4" X 0 100M X 200M RAW COAL/LIBERATION

	% WT.	% MOIST.	% ASH	%SULFUR	BTU	% VOL.	% FIX. CAR.
RAW	100.00	3.65	29.89	4.10	9110	0.00	0.00
			31.02	4.26	9455	0.00	0.00
					13706 (MAF)		

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		11.14	1.22	1.93	14086	0.00	0.00
1.30		13.45	1.95	2.13	14051	0.00	0.00
1.35		8.74	2.74	2.20	13899	0.00	0.00
1.40		13.45	3.89	2.27	13856	0.00	0.00
1.60		14.69	8.95	2.56	13161	0.00	0.00
1.80		4.45	17.24	3.25	11823	0.00	0.00
2.00		1.49	35.63	4.90	8793	0.00	0.00
2.45		2.09	66.48	5.77	3885	0.00	0.00
2.45	SINK	30.49	84.79	8.35	803	0.00	0.00

Thomas A. Rightmire
RAKly

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-6678

DATE : 5-28-91
MASTER WARNER NO. 106185

C. Q. , INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001
OPERATING CO.: PROJECT 90A0103
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 635.3 KG
DATE SAMPLED:
DATE RECEIVED: 042991

OTHER ID: RAW COAL SPLIT CRUSHED TO 3/4" X 0 LABORATORY SPLIT OF AS RECEIVED S AMPLE CRUSHED TO 3/4" X 0 100M X 200M RAW COAL/LIBERATION

CUMULATIVE RESULTS FOR RAW

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		11.14	1.22	1.93	14086	0.00	0.00
1.30		24.59	1.62	2.04	14067	0.00	0.00
1.35		33.33	1.91	2.08	14023	0.00	0.00
1.40		46.79	2.48	2.14	13975	0.00	0.00
1.60		61.47	4.03	2.24	13780	0.00	0.00
1.80		65.92	4.92	2.31	13648	0.00	0.00
2.00		67.41	5.60	2.36	13541	0.00	0.00
2.45		69.51	7.43	2.47	13250	0.00	0.00
2.45	SINK	100.00	31.02	4.26	9455	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	31.02	4.26	9455	0.00	0.00
1.30		88.86	34.75	4.55	8874	0.00	0.00
1.35		75.41	40.61	4.98	7951	0.00	0.00
1.40		66.67	45.57	5.35	7171	0.00	0.00
1.60		53.21	56.11	6.13	5480	0.00	0.00
1.80		38.53	74.09	7.49	2553	0.00	0.00
2.00		34.08	81.51	8.04	1343	0.00	0.00
2.45		32.59	83.61	8.18	1001	0.00	0.00
2.45	SINK	30.49	84.79	8.35	803	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Ryston

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
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St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5705

DATE : 5-24-91
MASTER WARNER NO. 106688

C.Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 635.30 KG

DATE SAMPLED:
DATE RECEIVED: 050391

OTHER ID: TEST DESCRIPTION RAW COAL\LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 3/4" X 0 LABORATORY SPLIT OF AS-RECEIVED SAMPLE CRUSHED TO 3/4" X 0 2 OOM X 0

	% WT.	% MOIST.	% ASH	%SULFUR	BTU	% VOL.	% FIX. CAR.
RAW	100.00	2.36	59.85	2.35	4935	0.00	0.00
			61.29	2.41	5054	0.00	0.00
					13056 (MAF)		

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		.02	2.13	1.80	13951	0.00	0.00
1.30		.05	2.34	1.88	13738	0.00	0.00
1.35		.32	3.24	1.93	13730	0.00	0.00
1.40		.37	3.31	1.95	13591	0.00	0.00
1.60		9.72	8.69	1.79	13092	0.00	0.00
1.80		7.34	14.91	1.52	12154	0.00	0.00
2.00		5.69	26.93	1.59	10286	0.00	0.00
2.45		37.93	62.99	1.79	4806	0.00	0.00
2.45	SINK	38.56	87.93	3.47	977	0.00	0.00

Thomas A. Lighton

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5896

DATE : 5-24-91
MASTER WARNER NO. 106688

C. Q. , INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO. : PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 635.30 KG

DATE SAMPLED:
DATE RECEIVED: 050391

OTHER ID: TEST DESCRIPTION RAW COAL\LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 3/4" X 0 LABORATORY SPLIT OF AS-RECEIVED SAMPLE CRUSHED TO 3/4" X 0 2 OOM X 0

CUMULATIVE RESULTS FOR RAW

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		.02	2.13	1.80	13951	0.00	0.00
1.30		.07	2.28	1.86	13796	0.00	0.00
1.35		.39	3.06	1.92	13743	0.00	0.00
1.40		.77	3.18	1.93	13669	0.00	0.00
1.60		10.48	8.29	1.80	13134	0.00	0.00
1.80		17.82	11.02	1.69	12730	0.00	0.00
2.00		23.51	14.86	1.66	12139	0.00	0.00
2.45		61.44	44.58	1.74	7612	0.00	0.00
2.45	SINK	100.00	61.29	2.41	5054	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	61.29	2.41	5054	0.00	0.00
1.30		99.98	61.30	2.41	5052	0.00	0.00
1.35		99.93	61.34	2.41	5047	0.00	0.00
1.40		99.61	61.52	2.41	5020	0.00	0.00
1.60		99.23	61.74	2.41	4987	0.00	0.00
1.80		89.52	67.50	2.48	4108	0.00	0.00
2.00		82.18	72.20	2.57	3389	0.00	0.00
2.45		76.49	75.56	2.64	2876	0.00	0.00
2.45	SINK	38.56	87.93	3.47	977	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Ryle

GOULD energy

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Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
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Weighing and Control Services, Inc. P.O Box 2374 Brandon, Florida 34299 813/689-5785

C.Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

DATE: 05/28/91
MASTER WARNER NO. 098415

SAMPLE ID: KENTUCKY #11 RUN #90113001 #41001

OPERATING CO: RAW COAL/LIBERATION
SAMPLED BY: CUSTOMER PROVIDED
DATE SAMPLED:

GROSS WEIGHT: 635.30 KG
DATE RECEIVED: 02/28/91

OTHER ID: RAW COAL SPLIT CRUSHED TO 3/4" X 0 LABORATORY SPLIT OF AS-RECEIVED SAMPLE CRUSHED TO 3/4" X 0 -28M MATERIAL WET SCREENED

FEED FOR SIZE +3/4" X 0

GRAVITY	WT%	% ASH	% SULFUR	BTU
1.25	7.77	3.01	2.26	14007
1.30	28.00	5.31	2.68	13672
1.35	15.09	9.99	3.20	12974
1.40	4.23	13.90	3.50	12322
1.60	7.88	23.54	3.72	10893
1.80	2.66	35.12	4.26	8913
2.00	1.25	43.57	5.46	7506
2.45	4.59	69.31	4.80	3599
2.45 SINK	28.53	88.05	6.37	775

CUMULATIVE DOWN

GRAVITY	WT%	ASH	SULFUR	BTU
1.25	7.77	3.01	2.26	14007
1.30	35.77	4.81	2.59	13745
1.35	50.86	6.35	2.77	13516
1.40	55.09	6.93	2.83	13424
1.60	62.97	9.01	2.94	13108
1.80	65.63	10.06	2.99	12938
2.00	66.88	10.69	3.04	12836
2.45	71.47	14.46	3.15	12243
2.45 SINK	100.00	35.45	4.07	8971

CUMULATIVE UP

GRAVITY	WT%	ASH	SULFUR	BTU
1.25	100.00	35.45	4.07	8971
1.30	92.23	38.18	4.22	8547
1.35	64.23	52.52	4.89	6313
1.40	49.14	65.58	5.41	4267
1.60	44.91	70.44	5.59	3508
1.80	37.03	80.42	5.99	1937
2.00	34.37	83.93	6.13	1397
2.45	33.12	85.45	6.15	1166
2.45 SINK	28.53	88.05	6.37	775

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Light
RACKL

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Galiltzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5-22-91
MASTER WARNER NO. 105563

C. Q. , INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO. : PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 295.40 KG

DATE SAMPLED:
DATE RECEIVED: 4/24/91

OTHER ID: DESCRIPTION RAW COAL/LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED T O 3/8" X 0 SAMPLE DESCRPITION LAB SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 3/8 " X 0

CERTIFICATE OF ANALYSIS

SCREEN SIZE	WT%	MOISTURE	ASH	SULFUR	BTU	LBS SO2 PER MBTU	MAF BTU
+3/8" SQ	2.90	4.29	54.26	3.86	6076	12.69	13282
3/8" SQ X 28M	86.41	5.40	34.60	3.83	9142	8.37	13977
28M X 100M	5.85	3.36	25.88	3.85	10496	7.33	14160
100M X 200M	1.21	3.90	33.36	4.56	9148	9.96	13728
200M X 0	3.63	3.27	63.57	2.33	4621	10.08	12682

CUMULATIVE RETAINED - DOWN

SCREEN SIZE	WT%	ASH	SULFUR	BTU	LBS SO2 PER MBTU
+3/8" SQ	2.90	54.26	3.86	6076	12.69
+3/8" SQ X 28M	89.31	35.24	3.83	9042	8.46
+3/8" SQ X 100M	95.15	34.66	3.83	9131	8.38
+3/8" SQ X 200M	96.37	34.65	3.84	9132	8.40
+3/8" SQ X 0	100.00	35.70	3.78	8968	8.42

CUMULATIVE RETAINED - UP

SCREEN SIZE	WT%	ASH	SULFUR	BTU	LBS SO2 PER MBTU
+3/8" SQ X 0	100.00	35.70	3.78	8968	8.42
3/8" SQ X 0	97.10	35.14	3.78	9054	8.34
28M X 0	10.69	39.53	3.41	8348	8.16
100M X 0	4.85	55.99	2.89	5756	10.03
200M X 0	3.63	63.57	2.33	4621	10.08

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

PAGE 1

APPROVED BY Thomas A. Lupton
APPROVED BY [illegible]

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Germania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/684-6676

DATE : 5-28-91
MASTER WARNER NO. 105569

C. Q. , INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY NO. 11 RUN NO. 2901130
01 SAMPLER NO. 41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 295.40 KG.

DATE SAMPLED: [illegible]
DATE RECEIVED: 4/24/91

OTHER ID: RAW COAL SPLIT CRUSHED TO 3/8-IN X 0 LABORATORY SPLIT OF AS RECEIVED
SAMPLE CRUSHED TO 3/8-IN X 0 RAW COAL/LIBERATION

FEED FOR SIZE +3/8"SQ X 28M

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		18.92	3.51	2.47	13821	0.00	0.00
1.30		15.39	5.60	2.85	13494	0.00	0.00
1.35		17.51	8.85	3.10	12954	0.00	0.00
1.40		2.74	14.09	3.51	12046	0.00	0.00
1.60		8.52	23.56	3.80	10612	0.00	0.00
1.80		3.06	38.60	4.32	8186	0.00	0.00
2.00		1.62	51.11	4.61	6410	0.00	0.00
2.45		4.01	73.73	4.63	2965	0.00	0.00
2.45	SINK	28.23	88.95	5.32	856	0.00	0.00

CUMULATIVE RESULTS FOR SIZE +3/8"SQ X 28M

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		18.92	3.51	2.47	13821	0.00	0.00
1.30		34.31	4.45	2.64	13674	0.00	0.00
1.35		51.81	5.94	2.79	13431	0.00	0.00
1.40		54.56	6.35	2.83	13361	0.00	0.00
1.60		63.08	8.67	2.96	12990	0.00	0.00
1.80		66.14	10.05	3.02	12768	0.00	0.00
2.00		67.76	11.04	3.06	12616	0.00	0.00
2.45		71.77	14.54	3.15	12076	0.00	0.00
2.45	SINK	100.00	35.55	3.76	8909	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	35.55	3.76	8909	0.00	0.00
1.30		81.08	43.02	4.06	7762	0.00	0.00
1.35		65.69	51.79	4.35	6420	0.00	0.00
1.40		48.19	67.39	4.80	4047	0.00	0.00
1.60		45.44	70.61	4.88	3564	0.00	0.00
1.80		36.92	81.47	5.13	1936	0.00	0.00
2.00		33.86	85.34	5.20	1372	0.00	0.00
2.45		32.24	87.06	5.23	1119	0.00	0.00
2.45	SINK	28.23	88.95	5.32	856	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Ryder

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813

DATE : 5-28-91
MASTER WARNER NO. 105569

C. Q., INC.
~~1 QUALITY CENTER BOX 280~~
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY NO. 11 RUN NO. 901130 01 SAMPLER NO 41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
DATE SAMPLED:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 295.40 KG.
DATE RECEIVED: 4/24/91

OTHER ID: RAW COAL SPLIT CRUSHED TO 3/8-IN X 0 LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 3/8-IN X 0 RAW COAL/LIBERATION

FEED FOR SIZE 28M X 100M

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		6.90	.97	1.89	14162	0.00	0.00
1.30		26.39	2.26	2.34	14045	0.00	0.00
1.35		13.21	4.13	2.72	13774	0.00	0.00
1.40		14.72	6.74	2.80	13410	0.00	0.00
1.60		9.88	14.53	3.17	12030	0.00	0.00
1.80		1.70	26.90	4.22	10193	0.00	0.00
2.00		1.57	38.68	5.15	8254	0.00	0.00
2.45		2.35	63.58	6.36	4234	0.00	0.00
2.45	SINK	23.28	85.14	7.33	622	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 28M X 100M

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		6.90	.97	1.89	14162	0.00	0.00
1.30		33.29	2.00	2.25	14069	0.00	0.00
1.35		46.50	2.60	2.38	13986	0.00	0.00
1.40		61.22	3.60	2.48	13847	0.00	0.00
1.60		71.10	5.12	2.58	13595	0.00	0.00
1.80		72.80	5.63	2.62	13515	0.00	0.00
2.00		74.37	6.32	2.67	13404	0.00	0.00
2.45		76.72	8.07	2.78	13124	0.00	0.00
2.45	SINK	100.00	26.02	3.84	10213	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	26.02	3.84	10213	0.00	0.00
1.30		93.10	27.87	3.99	9920	0.00	0.00
1.35		66.71	38.01	4.64	8288	0.00	0.00
1.40		53.50	46.37	5.11	6934	0.00	0.00
1.60		38.78	61.41	5.99	4476	0.00	0.00
1.80		28.90	77.44	6.95	1893	0.00	0.00
2.00		27.20	80.60	7.12	1374	0.00	0.00
2.45		25.63	83.17	7.24	953	0.00	0.00
2.45	SINK	23.28	85.14	7.33	622	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Ryhton
RQEKly

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-6788

DATE : 5-28-91
MASTER WARNER NO. 105569

C. G., INC.
~~1 QUALITY CENTER BOX 280~~
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY NO. 11 RUN NO. 901130
01 SAMPLER NO 41001

OPERATING CO. : PROJECT 90D0101 TASK 2.2
MINE: DATE SAMPLED:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 295.40 KG. DATE RECEIVED: 4/24/91

OTHER ID: RAW COAL SPLIT CRUSHED TO 3/8-IN X 0 LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 3/8-IN X 0 RAW COAL/LIBERATION

FEED FOR SIZE 100M X 200M

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		9.71	1.31	2.02	14058	0.00	0.00
1.30		9.55	1.73	2.22	13951	0.00	0.00
1.35		10.50	2.85	2.37	13995	0.00	0.00
1.40		9.83	3.58	2.41	13989	0.00	0.00
1.60		20.99	8.10	2.63	12820	0.00	0.00
1.80		3.51	20.23	3.67	11308	0.00	0.00
2.00		1.26	40.89	5.34	7957	0.00	0.00
2.45		2.96	70.80	5.25	3320	0.00	0.00
2.45	SINK	31.69	85.70	8.38	1505	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 100M X 200M

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		9.71	1.31	2.02	14058	0.00	0.00
1.30		19.26	1.52	2.12	14005	0.00	0.00
1.35		29.76	1.99	2.21	14001	0.00	0.00
1.40		39.58	2.38	2.26	13998	0.00	0.00
1.60		60.58	4.36	2.39	13590	0.00	0.00
1.80		64.09	5.23	2.46	13465	0.00	0.00
2.00		65.35	5.92	2.51	13358	0.00	0.00
2.45		68.31	8.73	2.63	12923	0.00	0.00
2.45	SINK	100.00	33.12	4.45	9305	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	33.12	4.45	9305	0.00	0.00
1.30		90.29	36.54	4.71	8794	0.00	0.00
1.35		80.74	40.66	5.01	8184	0.00	0.00
1.40		70.24	46.31	5.40	7316	0.00	0.00
1.60		60.42	53.26	5.89	6230	0.00	0.00
1.80		39.42	77.31	7.63	2721	0.00	0.00
2.00		35.91	82.89	8.01	1881	0.00	0.00
2.45		34.65	84.42	8.11	1660	0.00	0.00
2.45	SINK	31.69	85.70	8.38	1505	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Ryan
ROEK

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5-29-91
MASTER WARNER NO. 105569

C. Q. , INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY NO. 11 RUN NO. 901130
01 SAMPLER NO 41001

OPERATING CO. : PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 295.40 KG.

DATE SAMPLED:
DATE RECEIVED: 4/24/91

OTHER ID: RAW COAL SPLIT CRUSHED TO 3/8-IN X 0 LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 3/8-IN X 0 RAW COAL/LIBERATION

FEED FOR SIZE 200M X 0

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		.02	1.28	1.62	14051	0.00	0.00
1.30		.03	1.44	1.68	14047	0.00	0.00
1.35		.16	2.34	1.74	13856	0.00	0.00
1.40		.22	2.68	1.87	13684	0.00	0.00
1.60		7.57	6.07	1.86	13385	0.00	0.00
1.80		7.71	15.03	1.60	12166	0.00	0.00
2.00		6.29	26.36	1.57	10489	0.00	0.00
2.45		41.39	64.85	1.82	4508	0.00	0.00
2.45	SINK	36.59	88.50	3.88	1026	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 200M X 0

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		.02	1.28	1.62	14051	0.00	0.00
1.30		.06	1.37	1.65	14048	0.00	0.00
1.35		.22	2.09	1.72	13906	0.00	0.00
1.40		.45	2.38	1.79	13795	0.00	0.00
1.60		8.02	5.86	1.85	13408	0.00	0.00
1.80		15.73	10.36	1.73	12799	0.00	0.00
2.00		22.02	14.92	1.68	12139	0.00	0.00
2.45		63.41	47.52	1.77	7158	0.00	0.00
2.45	SINK	100.00	62.51	2.55	4914	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	62.51	2.55	4914	0.00	0.00
1.30		99.98	62.53	2.55	4912	0.00	0.00
1.35		99.94	62.55	2.55	4909	0.00	0.00
1.40		99.78	62.64	2.55	4894	0.00	0.00
1.60		99.55	62.78	2.55	4875	0.00	0.00
1.80		91.98	67.45	2.61	4174	0.00	0.00
2.00		84.27	72.25	2.70	3443	0.00	0.00
2.45		77.98	75.95	2.79	2874	0.00	0.00
2.45	SINK	36.59	88.50	3.88	1026	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Rychtar

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5-29-91
MASTER WARNER NO. 105569

C. Q. , INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY NO. 11 RUN NO. 901130
01 SAMPLER NO 41001

OPERATING CO. : PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 295.40 KG.

DATE SAMPLED:
DATE RECEIVED: 4/24/91

OTHER ID: RAW COAL SPLIT CRUSHED TO 3/8-IN X 0 LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 3/8-IN X 0 RAW COAL/LIBERATION

FEED FOR COMPOSITE +3/8" SQ X 0

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		17.42	3.44	2.45	13831	0.00	0.00
1.30		15.40	5.24	2.79	13552	0.00	0.00
1.35		16.54	8.58	3.07	13000	0.00	0.00
1.40		3.44	11.86	3.29	12459	0.00	0.00
1.60		8.72	21.96	3.66	10858	0.00	0.00
1.80		3.15	35.89	4.07	8645	0.00	0.00
2.00		1.78	47.21	4.26	7040	0.00	0.00
2.45		5.26	70.91	3.87	3442	0.00	0.00
2.45	SINK	28.28	88.71	5.39	862	0.00	0.00

CUMULATIVE RESULTS FOR COMPOSITE +3/8" SQ X 0

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		17.42	3.44	2.45	13831	0.00	0.00
1.30		32.82	4.28	2.61	13700	0.00	0.00
1.35		49.36	5.72	2.77	13466	0.00	0.00
1.40		52.80	6.12	2.80	13400	0.00	0.00
1.60		61.52	8.37	2.92	13040	0.00	0.00
1.80		64.67	9.71	2.98	12826	0.00	0.00
2.00		66.46	10.71	3.01	12670	0.00	0.00
2.45		71.72	15.13	3.08	11993	0.00	0.00
2.45	SINK	100.00	35.94	3.73	8845	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	35.94	3.73	8845	0.00	0.00
1.30		82.58	42.80	4.00	7793	0.00	0.00
1.35		67.18	51.41	4.28	6473	0.00	0.00
1.40		50.64	65.40	4.67	4341	0.00	0.00
1.60		47.20	69.30	4.77	3749	0.00	0.00
1.80		38.48	80.02	5.02	2138	0.00	0.00
2.00		35.33	83.96	5.11	1558	0.00	0.00
2.45		33.54	85.92	5.15	1266	0.00	0.00
2.45	SINK	28.28	88.71	5.39	862	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Ryht

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE: 6-14-91
MASTER WARNER NO. 105563

C. Q., INC.
I QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
SAMPLED BY: CUSTOMER PROVIDED
MINE:
LOCATION:

DATE SAMPLED:
DATE RECEIVED: 4/24/91

WEATHER:
GROSS WEIGHT: 295.40 KG

OTHER ID: DESCRIPTION RAW COAL/LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 3/8" X 0 SAMPLE DESCRPITION LAB SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 3/8" X 0

CERTIFICATE OF ANALYSIS

		AS RECEIVED	DRY BASIS
MOISTURE	D2961 D3302 D3173	10.28%	XXX
VOLATILE MATTER	D3175	26.10%	29.10%
FIXED CARBON	D3172	31.84%	35.48%
ASH	D3174	31.78%	35.42%
SULFUR	D4239 METHOD 3.3	3.39%	3.78%
CARBON	D3178	44.56%	49.67%
HYDROGEN	D3178	3.38%	3.77%
NITROGEN	D3179	.89%	1.00%
OXYGEN	D3176	5.72%	6.36%
BTU/LB	D2015	8094	9022
MAF BTU/LB			13970
LBS OF SO2 PER MILLION BTU			8.37
HARDGROVE GRINDABILITY INDEX	D409	52	
FORMS OF SULFUR	D2492		
PYRITIC SULFUR		1.78%	1.99%
SULFATE SULFUR		.09%	.10%
ORGANIC SULFUR		1.52%	1.70%
CHLORINE	D4208	.07%	.08%
EQUILIBRIUM MOISTURE	D1412	8.59%	

BLACK SEAL ANALYSIS

Lori Patney
Thomas A. Ryktin

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE: 5- 1-91
WARNER NO. 105563

CERTIFICATE OF ANALYSIS (CONT.)

	AS RECEIVED	DRY BASIS
ASH FUSION TEMPERATURE(S)		
D1857 - ELECTRIC METHOD	REDUCING ATMOSPHERE	
INITIAL DEFORMATION TEMPERATURE	2120	
SOFTENING TEMPERATURE	2175	
HEMISPHERICAL TEMPERATURE	2320	
FLUID TEMPERATURE	2420	
D1857	OXIDIZING ATMOSPHERE	
INITIAL DEFORMATION TEMPERATURE	2340	
SOFTENING TEMPERATURE	2395	
HEMISPHERICAL TEMPERATURE	2435	
FLUID TEMPERATURE	2495	

ASH MINERAL COMPOSITION
D2795 D3682

SILICON DIOXIDE	53.54
ALUMINIUM OXIDE	21.16
FERRIC OXIDE	10.99
TITANIUM DIOXIDE	.82
PHOSPHORUS PENTOXIDE	1.51
CALCIUM OXIDE	5.95
MAGNESIUM OXIDE	1.08
SODIUM OXIDE	.74
POTASSIUM OXIDE	2.60
SULFUR TRIOXIDE	2.32
PERCENT SOLIDS	89.72%

LITHIUM OXIDE	48.4 ppm
MANGANESE DIOXIDE	0.03 %

APPROVED BY Thomas A. Rupkalvis

APPROVED BY

BLACK SEAL ANALYSIS

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Germania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 5-31-91
MASTER WARNER NO. 109244

C.Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 13037.5 GRAMS

DATE SAMPLED:
DATE RECEIVED: 052291

OTHER ID: RAW COAL / LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 28M X 0
SAMPLE DESCRIPTION LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 28M X 0

CERTIFICATE OF ANALYSIS

SCREEN SIZE	WT%	MOISTURE	ASH	SULFUR	BTU	LBS SO2 PER MBTU	MAF BTU
+28M	4.00	3.04	59.03	10.14	5039	40.21	12299
28M X 100M	53.56	3.17	21.85	4.10	10924	7.50	13978
100M X 200M	11.92	1.98	23.05	4.16	10483	7.93	13622
200M X 0	30.52	1.45	59.31	2.85	5314	10.72	13061

CUMULATIVE RETAINED - DOWN

SCREEN SIZE	WT%	ASH	SULFUR	BTU	LBS SO2 PER MBTU
+28M	4.00	59.03	10.14	5039	40.21
+28M X 100M	57.55	24.43	4.52	10515	8.59
+28M X 200M	69.48	24.20	4.46	10510	8.48
+28M X 0	100.00	34.91	3.97	8924	8.89

CUMULATIVE RETAINED - UP

SCREEN SIZE	WT%	ASH	SULFUR	BTU	LBS SO2 PER MBTU
+28M X 0	100.00	34.91	3.97	8924	8.89
28M X 0	96.00	33.91	3.71	9086	8.16
100M X 0	42.45	49.13	3.22	6766	9.51
200M X 0	30.52	59.31	2.85	5314	10.72

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

PAGE 1

APPROVED BY Thomas A. Light
APPROVED BY

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/[illegible]

DATE : 5-31-91
MASTER WARNER NO. 109249

C. Q. , INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 13037.5 GRAMS

DATE SAMPLED:
DATE RECEIVED: 052291

OTHER ID: RAW COAL / LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 28M X 0
SAMPLE DESCRIPTION LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 28M X 0

FEED FOR SIZE +28M X 100M

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		4.10	1.02	1.90	13858	0.00	0.00
1.30		17.96	2.40	2.38	13737	0.00	0.00
1.35		29.09	3.84	2.69	13702	0.00	0.00
1.40		13.06	6.89	3.04	13153	0.00	0.00
1.60		9.06	14.97	3.75	11972	0.00	0.00
1.80		2.23	29.34	4.30	9732	0.00	0.00
2.00		1.15	43.29	6.74	7349	0.00	0.00
2.45		1.80	66.30	6.75	3888	0.00	0.00
2.45	SINK	21.57	85.84	9.56	943	0.00	0.00

CUMULATIVE RESULTS FOR SIZE +28M X 100M

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		4.10	1.02	1.90	13858	0.00	0.00
1.30		22.06	2.14	2.29	13759	0.00	0.00
1.35		51.14	3.11	2.52	13727	0.00	0.00
1.40		64.20	3.88	2.62	13610	0.00	0.00
1.60		73.26	5.25	2.76	13407	0.00	0.00
1.80		75.49	5.96	2.81	13299	0.00	0.00
2.00		76.64	6.52	2.87	13210	0.00	0.00
2.45		78.43	7.89	2.96	12997	0.00	0.00
2.45	SINK	100.00	24.70	4.38	10397	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	24.70	4.38	10397	0.00	0.00
1.30		95.90	25.71	4.49	10249	0.00	0.00
1.35		77.94	31.08	4.97	9446	0.00	0.00
1.40		48.86	47.30	6.33	6912	0.00	0.00
1.60		35.80	62.04	7.53	4634	0.00	0.00
1.80		26.74	77.99	8.81	2148	0.00	0.00
2.00		24.51	82.42	9.22	1459	0.00	0.00
2.45		23.36	84.33	9.34	1170	0.00	0.00
2.45	SINK	21.57	85.84	9.56	943	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Richter
Rocky

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
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St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813

DATE : 5-31-91
MASTER WARNER NO. 109249

C. Q., INC.
~~1 QUALITY CENTER BOX 280~~
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 13037.5 GRAMS

DATE SAMPLED:
DATE RECEIVED: 052291

OTHER ID: RAW COAL / LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 28M X 0
SAMPLE DESCRIPTION LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 28M X 0

FEED FOR SIZE 100M X 200M

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	4.04	1.06	1.89	14014	0.00	0.00
1.30	14.52	1.84	2.29	13876	0.00	0.00
1.35	13.15	2.33	2.46	13746	0.00	0.00
1.40	14.25	3.12	2.53	13679	0.00	0.00
1.60	27.08	7.49	2.93	13233	0.00	0.00
1.80	2.86	24.56	4.50	10516	0.00	0.00
2.00	1.10	39.79	6.10	7980	0.00	0.00
2.45	2.28	70.44	5.11	3273	0.00	0.00
2.45 SINK	20.72	84.97	9.45	986	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 100M X 200M

CUMULATIVE DOWN

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	4.04	1.06	1.89	14014	0.00	0.00
1.30	18.56	1.67	2.20	13906	0.00	0.00
1.35	31.71	1.95	2.31	13840	0.00	0.00
1.40	45.96	2.31	2.38	13790	0.00	0.00
1.60	73.04	4.23	2.58	13584	0.00	0.00
1.80	75.90	5.00	2.65	13468	0.00	0.00
2.00	77.00	5.49	2.70	13389	0.00	0.00
2.45	79.28	7.36	2.77	13099	0.00	0.00
2.45 SINK	100.00	23.44	4.16	10589	0.00	0.00

CUMULATIVE UP

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	100.00	23.44	4.16	10589	0.00	0.00
1.30	95.96	24.39	4.25	10445	0.00	0.00
1.35	81.44	28.41	4.60	9833	0.00	0.00
1.40	68.29	33.43	5.01	9079	0.00	0.00
1.60	54.04	41.41	5.67	7867	0.00	0.00
1.80	26.96	75.48	8.42	2477	0.00	0.00
2.00	24.10	81.54	8.89	1521	0.00	0.00
2.45	23.00	83.53	9.02	1212	0.00	0.00
2.45 SINK	20.72	84.97	9.45	986	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
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St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/[illegible]

DATE : 5-31-91
MASTER WARNER NO. 109249

C. Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 13037.5 GRAMS

DATE SAMPLED:
DATE RECEIVED: 052291

OTHER ID: RAW COAL / LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 28M X 0
SAMPLE DESCRIPTION LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 28M X 0

FEED FOR SIZE 200M X 0

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		.05	1.38	2.01	13945	0.00	0.00
1.30		.14	1.63	1.85	13888	0.00	0.00
1.35		1.68	2.20	2.20	14149	0.00	0.00
1.40		3.29	3.06	2.06	13670	0.00	0.00
1.60		20.39	9.63	2.13	12941	0.00	0.00
1.80		6.12	17.64	2.09	11794	0.00	0.00
2.00		4.58	28.52	2.18	10156	0.00	0.00
2.45		10.80	68.97	2.22	3827	0.00	0.00
2.45	SINK	52.95	89.85	3.83	807	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 200M X 0

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		.05	1.38	2.01	13945	0.00	0.00
1.30		.19	1.57	1.89	13902	0.00	0.00
1.35		1.87	2.13	2.17	14123	0.00	0.00
1.40		5.17	2.73	2.10	13834	0.00	0.00
1.60		25.56	8.23	2.12	13122	0.00	0.00
1.80		31.68	10.05	2.12	12865	0.00	0.00
2.00		36.25	12.38	2.12	12523	0.00	0.00
2.45		47.05	25.37	2.14	10527	0.00	0.00
2.45	SINK	100.00	59.51	3.04	5380	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	59.51	3.04	5380	0.00	0.00
1.30		99.95	59.54	3.04	5376	0.00	0.00
1.35		99.81	59.62	3.04	5364	0.00	0.00
1.40		98.13	60.61	3.05	5214	0.00	0.00
1.60		94.83	62.60	3.09	4920	0.00	0.00
1.80		74.44	77.12	3.35	2722	0.00	0.00
2.00		68.32	82.44	3.46	1910	0.00	0.00
2.45		63.75	86.31	3.55	1318	0.00	0.00
2.45	SINK	52.95	89.85	3.83	807	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Light

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
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Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813

DATE : 5-31-91
MASTER WARNER NO. 109249

C. Q., INC.
~~1 QUALITY CENTER BOX 280~~
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 13037.5 GRAMS

DATE SAMPLED:
DATE RECEIVED: 052291

OTHER ID: RAW COAL / LIBERATION SAMPLE NAME RAW COAL SPLIT CRUSHED TO 28M X 0
SAMPLE DESCRIPTION LABORATORY SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 28M X 0

FEED FOR COMPOSITE +28M X 0

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	2.86	1.03	1.90	13885	0.00	0.00
1.30	12.11	2.31	2.37	13757	0.00	0.00
1.35	18.82	3.67	2.66	13718	0.00	0.00
1.40	10.22	5.89	2.86	13291	0.00	0.00
1.60	14.67	11.06	2.88	12661	0.00	0.00
1.80	3.49	22.61	3.14	10911	0.00	0.00
2.00	2.19	33.65	3.79	9179	0.00	0.00
2.45	4.60	68.46	3.40	3808	0.00	0.00
2.45 SINK	31.04	87.86	6.57	876	0.00	0.00

CUMULATIVE RESULTS FOR COMPOSITE +28M X 0

CUMULATIVE DOWN

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	2.86	1.03	1.90	13885	0.00	0.00
1.30	14.97	2.07	2.28	13781	0.00	0.00
1.35	33.79	2.96	2.49	13746	0.00	0.00
1.40	44.01	3.64	2.57	13640	0.00	0.00
1.60	58.68	5.50	2.65	13396	0.00	0.00
1.80	62.17	6.46	2.68	13256	0.00	0.00
2.00	64.36	7.38	2.72	13118	0.00	0.00
2.45	68.96	11.46	2.76	12496	0.00	0.00
2.45 SINK	100.00	35.17	3.94	8889	0.00	0.00

CUMULATIVE UP

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	100.00	35.17	3.94	8889	0.00	0.00
1.30	97.14	36.18	4.00	8742	0.00	0.00
1.35	85.03	41.00	4.24	8028	0.00	0.00
1.40	66.21	51.61	4.68	6410	0.00	0.00
1.60	55.99	59.96	5.02	5154	0.00	0.00
1.80	41.32	77.32	5.78	2489	0.00	0.00
2.00	37.83	82.36	6.02	1712	0.00	0.00
2.45	35.64	85.35	6.16	1254	0.00	0.00
2.45 SINK	31.04	87.86	6.57	876	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
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St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5785

DATE : 6- 4-91
MASTER WARNER NO. 110672

C. Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1448.50

DATE SAMPLED:

DATE RECEIVED: 060391

OTHER ID: SAMPLE NAME RAW COAL SPLIT CRUSHED TO 100M X 0 LAB SPLIT OF THE RECEIVED SAMPLE CRUSHED TO 100M X 0 (WET SCREEN)

CERTIFICATE OF ANALYSIS

SCREEN SIZE	WT%	MOISTURE	ASH	SULFUR	BTU	LBS SO2 PER MBTU	MAF BTU
+100M	1.96	4.78	24.74	6.73	10657	12.62	14159
100M X 200M	24.54	2.16	17.54	4.15	11617	7.14	14087
200M X 0	73.50	1.49	40.81	3.32	8037	8.25	13578

CUMULATIVE RETAINED - DOWN

SCREEN SIZE	WT%	ASH	SULFUR	BTU	LBS SO2 PER MBTU
+100M	1.96	24.74	6.73	10657	12.62
+100M X 200M	26.50	18.07	4.34	11546	7.51
+100M X 0	100.00	34.78	3.59	8967	8.00

CUMULATIVE RETAINED - UP

SCREEN SIZE	WT%	ASH	SULFUR	BTU	LBS SO2 PER MBTU
+100M X 0	100.00	34.78	3.59	8967	8.00
100M X 0	98.04	34.99	3.53	8933	7.90
200M X 0	73.50	40.81	3.32	8037	8.25

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

PAGE 1

APPROVED BY Thomas A. Right

APPROVED BY Paul T. Gruleny

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5705

DATE : 6- 4-91
MASTER WARNER NO. 110676

C Q , INC
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1448.50

DATE SAMPLED:
DATE RECEIVED: 060391

OTHER ID: SAMPLE NAME RAW COAL SPLIT CRUSHED TO 100M X 0 LAB SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 100M X 0

FEED FOR SIZE 100M X 200M

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		13.36	.96	1.88	14169	0.00	0.00
1.30		18.15	2.20	2.36	13948	0.00	0.00
1.35		16.63	3.01	2.48	13820	0.00	0.00
1.40		19.78	4.62	2.62	13634	0.00	0.00
1.60		12.10	11.20	3.32	12575	0.00	0.00
1.80		2.49	23.21	4.41	10740	0.00	0.00
2.00		.93	41.29	6.13	7891	0.00	0.00
2.45		1.67	69.84	5.33	2814	0.00	0.00
2.45	SINK	14.88	82.79	11.70	1064	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 100M X 200M

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		13.36	.96	1.88	14169	0.00	0.00
1.30		31.51	1.68	2.16	14042	0.00	0.00
1.35		48.14	2.14	2.27	13965	0.00	0.00
1.40		67.93	2.86	2.37	13869	0.00	0.00
1.60		80.03	4.12	2.51	13673	0.00	0.00
1.80		82.52	4.70	2.57	13585	0.00	0.00
2.00		83.44	5.11	2.61	13521	0.00	0.00
2.45		85.12	6.38	2.66	13311	0.00	0.00
2.45	SINK	100.00	17.75	4.01	11488	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	17.75	4.01	11488	0.00	0.00
1.30		86.64	20.34	4.33	11075	0.00	0.00
1.35		68.49	25.15	4.86	10313	0.00	0.00
1.40		51.86	32.24	5.62	9188	0.00	0.00
1.60		32.07	49.28	7.48	6446	0.00	0.00
1.80		19.97	72.36	10.00	2732	0.00	0.00
2.00		17.48	79.35	10.79	1593	0.00	0.00
2.45		16.56	81.48	11.05	1240	0.00	0.00
2.45	SINK	14.88	82.79	11.70	1064	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Rafferty

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
Warner Laboratories Division Gallitzin Road, P.O. Box 244, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/[illegible]

DATE : 6- 4-91
MASTER WARNER NO. 110676

C.Q., INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1448.50

DATE SAMPLED:
DATE RECEIVED: 060391

OTHER ID: SAMPLE NAME RAW COAL SPLIT CRUSHED TO 100M X 0 LAB SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 100M X 0

FEED FOR SIZE 200M X 0

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		.24	1.99	1.93	13674	0.00	0.00
1.30		2.23	2.39	2.06	13651	0.00	0.00
1.35		7.47	3.31	2.19	13483	0.00	0.00
1.40		8.23	4.95	1.94	13218	0.00	0.00
1.60		31.65	8.40	2.17	13005	0.00	0.00
1.80		7.07	22.19	2.54	10944	0.00	0.00
2.00		2.53	36.39	2.90	8815	0.00	0.00
2.45		8.03	70.86	2.24	3282	0.00	0.00
2.45	SINK	32.55	87.25	6.08	935	0.00	0.00

CUMULATIVE RESULTS FOR SIZE 200M X 0

CUMULATIVE DOWN

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		.24	1.99	1.93	13674	0.00	0.00
1.30		2.47	2.35	2.04	13653	0.00	0.00
1.35		9.94	3.07	2.15	13525	0.00	0.00
1.40		18.17	3.92	2.06	13386	0.00	0.00
1.60		49.82	6.77	2.13	13144	0.00	0.00
1.80		56.89	8.69	2.18	12871	0.00	0.00
2.00		59.42	9.86	2.21	12698	0.00	0.00
2.45		67.45	17.13	2.22	11577	0.00	0.00
2.45	SINK	100.00	39.95	3.47	8113	0.00	0.00

CUMULATIVE UP

GRAVITY		% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25		100.00	39.95	3.47	8113	0.00	0.00
1.30		99.76	40.04	3.48	8099	0.00	0.00
1.35		97.53	40.90	3.51	7972	0.00	0.00
1.40		90.06	44.02	3.62	7515	0.00	0.00
1.60		81.83	47.95	3.79	6941	0.00	0.00
1.80		50.18	72.90	4.80	3118	0.00	0.00
2.00		43.11	81.21	5.18	1834	0.00	0.00
2.45		40.58	84.00	5.32	1399	0.00	0.00
2.45	SINK	32.55	87.25	6.08	935	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Lykins

GOULD energy

Gould Energy 30 Clairmont Avenue, Thornwood, New York 10594 914/769 7900
Warner Laboratories Division Gallitzin Road, P.O. Box 214, Cresson, Pennsylvania 16630 814/886-7400
Warner Laboratories of West Virginia Division Route 50 East, P.O. Box 98, Gormania, West Virginia 26720 304/693-7613
Fuel Engineering Division 30 Clairmont Avenue, Thornwood, New York 10594 914/769-7900
St. Louis Energy Division 11591 Page Service Drive, St. Louis, Missouri 63146 314/432-0414
Weighing and Control Services, Inc. P.O. Box 2374 Brandon, Florida 34299 813/689-5795

DATE : 6- 4-91
MASTER WARNER NO. 110676

C. Q. , INC.
1 QUALITY CENTER BOX 280
HOMER CITY, PA 15748

SAMPLE ID: KENTUCKY #11 RUN #90113001
SAMPLER #41001

OPERATING CO.: PROJECT 90D0101 TASK 2.2
MINE:
SAMPLED BY: CUSTOMER PROVIDED
GROSS WEIGHT: 1448.50

DATE SAMPLED:
DATE RECEIVED: 060391

OTHER ID: SAMPLE NAME RAW COAL SPLIT CRUSHED TO 100M X 0 LAB SPLIT OF AS RECEIVED SAMPLE CRUSHED TO 100M X 0

FEED FOR COMPOSITE 100M X 0

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	3.53	1.01	1.89	14144	0.00	0.00
1.30	6.21	2.25	2.28	13869	0.00	0.00
1.35	9.76	3.18	2.31	13627	0.00	0.00
1.40	11.12	4.80	2.24	13403	0.00	0.00
1.60	26.75	8.72	2.30	12956	0.00	0.00
1.80	5.92	22.30	2.74	10923	0.00	0.00
2.00	2.13	36.92	3.25	8714	0.00	0.00
2.45	6.44	70.79	2.44	3252	0.00	0.00
2.45 SINK	28.13	86.66	6.82	952	0.00	0.00

CUMULATIVE RESULTS FOR COMPOSITE 100M X 0

CUMULATIVE DOWN

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	3.53	1.01	1.89	14144	0.00	0.00
1.30	9.74	1.80	2.13	13968	0.00	0.00
1.35	19.50	2.49	2.22	13797	0.00	0.00
1.40	30.63	3.33	2.23	13654	0.00	0.00
1.60	57.38	5.84	2.26	13329	0.00	0.00
1.80	63.30	7.38	2.31	13104	0.00	0.00
2.00	65.43	8.35	2.34	12961	0.00	0.00
2.45	71.87	13.94	2.35	12091	0.00	0.00
2.45 SINK	100.00	34.40	3.61	8958	0.00	0.00

CUMULATIVE UP

GRAVITY	% WT	% ASH	% S	BTU	VOLATILE	FIXED CARBON
1.25	100.00	34.40	3.61	8958	0.00	0.00
1.30	96.47	35.61	3.67	8768	0.00	0.00
1.35	90.26	37.91	3.76	8417	0.00	0.00
1.40	80.50	42.12	3.94	7785	0.00	0.00
1.60	69.37	48.11	4.21	6884	0.00	0.00
1.80	42.62	72.83	5.41	3072	0.00	0.00
2.00	36.70	80.99	5.85	1806	0.00	0.00
2.45	34.57	83.70	6.01	1380	0.00	0.00
2.45 SINK	28.13	86.66	6.82	952	0.00	0.00

ANALYTICAL RESULTS ARE STATED ON A DRY BASIS

Thomas A. Kuhn[illegible]